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State of New York.

State Hospitals Bulletin

A QUARTERLY REPORT OF CLINICAL AND PATHOLOGICAL WORK
IN THE STATE HOSPITALS (FOR THE INSANE), AND
THEIR PATHOLOGICAL INSTITUTE.

[Published by authority of the State Commission in Lunacy.]

VOL. II.

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And the DIRECTOR OF THE PATHOLOGICAL INSTITUTE.**

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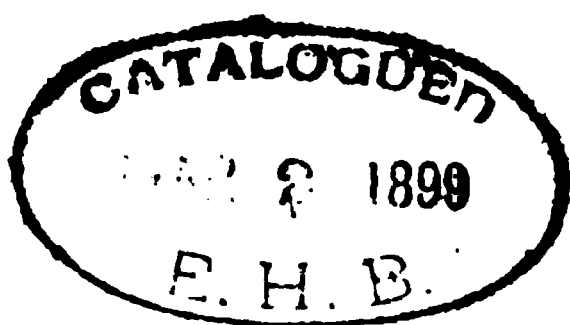
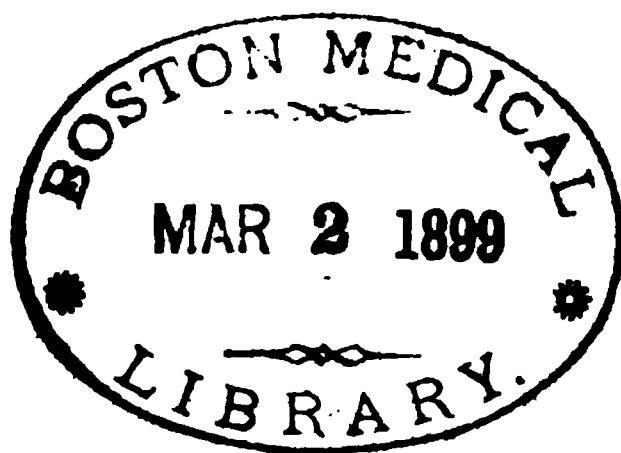


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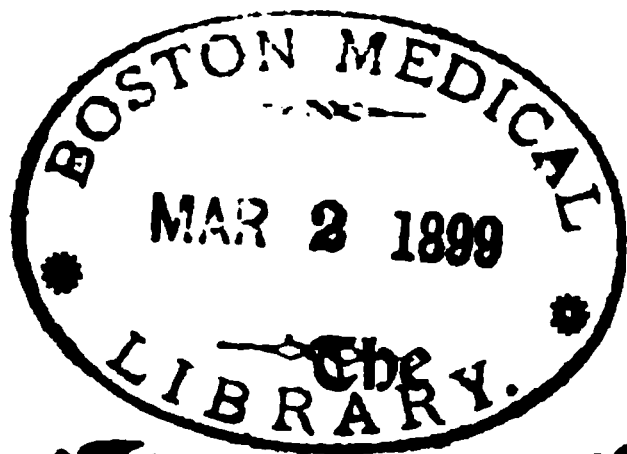
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EDITORIAL NOTICE.

Beginning with the number for January, 1898, this publication will issue under the name "ARCHIVES OF NEUROLOGY AND PSYCHO-PATHOLOGY." The editors believe that the new title will define the scope of this quarterly bulletin with greater clearness. During the past two years free copies of the BULLETIN have been lavishly distributed to alienists and neurologists at home and abroad, particularly those of Great Britain and Ireland, with the object of introducing the magazine to the notice of possible subscribers. The new title will signalize the emergence of the BULLETIN from the experimental stage of its existence. If silent readers who have been satisfied with the quality of the articles published now desire to convey the assurance of such satisfaction to the editors, a subscription will be gladly and gratefully accepted as the substantial token of their good will.

Hereafter the annual subscription, beginning with the January issue, will be \$3.00; single copies, \$0.75.

Remittances may be addressed to the manager, Archives of Neurology and Psycho-Pathology, State Hospital, Utica, N. Y.



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**PATHOLOGICAL INSTITUTE OF THE NEW
YORK STATE HOSPITALS.**

DEPARTMENT OF ANTHROPOLOGY.

**OUTLINE OF ITS SCOPE AND EXPOSITION OF THE PRELIM-
INARY WORK.**

**BY DR. ALOIS F. HRDLICKA,
Associate in Anthropology.**

PART I.

I.—Having been appointed to the position of Anthropologist at the Pathological Institute, I think it is my duty to show, at least in a preliminary way, in the first place what and how much the science I am to propagate can do in the study of the insane; and to point out, next, whereat and how anthropological work should be started without delay. A complete minute programme of the work to be done by this department of the Institute is to follow later, if found necessary.

II.—The scope of Anthropology is very large; in order that it may be well understood, it is necessary to dwell, first of all, at some length on the definition of the term.

The name Anthropology is quite ancient. It was used the first time, as far as we know, by Aristotle, who denominated with its derivative those Grecian philosophers who were engaged in controversies on the moral nature of man. From the time of Aristotle up to the end of the 18th century no progress was realized in this science,

although the name Anthropology appears as the title of several treatises of a more or less vague philosophical nature. Finally in 1795, Blumenbach restricted the term to purely natural studies; he applied the name Anthropology to the studies of man and human races, and it is fundamentally in this sense that the term has been used since Blumenbach, and is used at present.

The evolution of the science up to this date has not materially changed, but has enlarged considerably and crystallized Blumenbach's conception. His definition of the science as a "study of man and his races" was found to be rather too broad and indefinite, almost equally so as the verbal translation of the name Anthropology alone, namely "the science of man." It was found needless to include with the conception such studies, for instance, as may simply treat of some indirect methods (as, for example, the studies of various analyses, or of various examination methods, as of microscopy, of ophthalmoscopy, etc.) or those investigations whose object is purely the physician's or the surgeon's, concerning entirely the healing art and treatment; while on the other hand zoology, geology and other branches were found to be important concomitants. Due to these modifications, a definition of Anthropology at the present reads usually as follows:

Anthropology is that part of natural science in general which embodies all those branches of knowledge of which man or any of his variations is the direct or the final object, except those parts of these branches which simply treat of some indirect method of investigation, or of some practical application and use of the sciences.

This "abstract" of definitions comprises fairly well the scope of Anthropology, yet it is hardly clear enough for all circumstances. The science, it is true, involves all the branches of natural study or at least all those which have any relation to man; but it should not be understood that to be an anthropologist implies continuous research in all those branches of studies. In order to be able to become an anthropologist one must have at least a com-

prehensive general knowledge of these various branches of natural science. He ought to be a fair anatomist and physiologist, and something of a sociologist, archæologist, geologist, etc. But he can not be expected to actively follow all these branches into their minute evolutions. A knowledge of them serves the would-be anthropologist simply as a basis, without which he could not safely undertake a study which requires such a broad understanding and consists so much of comparisons. He is to know the individual man from all standpoints *a priori*, including his bearing on natural history. And it is only then that commences his task as an anthropologist, a task which consists in the learning of other men from the same standpoints, and in comparing them with the first known individual, so as to define any possible variation, and to differentiate man on the basis of such variations and to explain, or at least to establish, the causes of such differences. Anthropology becomes thus a study of varieties of mankind, of comparisons of the same, and of scientific deductions from the obtained data.

Varieties in mankind are of two principal kinds, and they determine in turn an important division, into two corresponding kinds, of comparisons and deductions. . . When we examine any one class of men, we find invariably that each individual differs more or less from all the others of the class taken. The average in all respects of a class examined may be said to be typical of this class; all the averages oscillate within definite limits; outside the limits of an average there is an array of variations. A scrutiny of these variations shows them to be of two orders, namely: Those that do not in any way affect the type or any part of the type of a group under consideration, and which are termed therefore indifferent characters and may be said to be within the range of the normal; and those variations which do affect the average or normal types, and which are therefore called, anthropologically, abnormal. And right here let me impress upon the reader that this anthropological abnormality is by no means synonymous with the patho-

logical abnormality, or that due to a disease, but involves everything atypical which is above or below the indifferent characters as explained above. It matters not what may be the causes of this atypical something and whatever be its appellation, or whether it be a defect or improvement on the normal. To elucidate these few points more closely, a few examples may be instanced. Slight modifications of growth, as, for instance, a slightly irregular ear; or a little change of function, as a somewhat more slow or rapid action of the heart or of the bowels, or a little longer average duration of sleep; or a slight difference of the psychical faculties, as a little greater or lesser power of recollection of facts of certain kinds, or little differences in the character of the individual—all these are indifferent variations and a subject possessing them is still within the normal. But, augment any of these modifications to such an extent that the possessor of any one of them has to be looked at in that particular respect as an exception to the average, and those variations are, from an anthropological point of view, abnormal. The abnormality is proportionate to the characters of the variation.

A clear, short definition of the "science of man," after these considerations, would be: Anthropology is a science of everything normal and abnormal of man and mankind, and of comparisons and explanations of these characters.

III.—The prolonged explanation of what Anthropology really is, was necessary for making plain what can be expected of the science in the study of the various abnormal classes of society. This section will be more specific and deal directly with the aims of the anthropological division of the Institute.

The object of the Department of Anthropology of the Pathological Institute will be, above all, to establish a solid normal standard of the American people, or, at least, such a standard, if this be possible, of the native population of the State of New York; and at the same time to examine all those classes of the population which by

their manifestations amply demonstrate that they are abnormal—such as the insane, the criminals, the epileptics, the idiots, etc. The examinations finished, the subsequent tasks will be to study the found variations and their causes; to find which of the anatomical, physiological and psychological abnormal characters are peculiar to each of these classes, or, if that be impossible, to show which abnormalities predominate in each class; to establish how each of these offspring-classes differs from the normal and the one from the other; to find explanations for the variations; and, lastly, to compare the results with similar ones obtained in similar classes among different peoples.

The object comprises two distinct procedures. On one side, thorough, systematized investigations must be conducted with the view of obtaining all important data regarding the living; and on the other side, a gathering of various anatomical specimens, such as skulls, brains, etc., must be organized. These gatherings will amount in time to large and valuable collections of such material which can not be studied in the living, and which will serve as a basis for further anthropological studies and comparisons, studies which will serve to complete the knowledge which has been in the meantime obtained of the various classes of living people.

This, in brief, is the goal of the Anthropological Department of the Pathological Institute. The attainment of such extensive projects is, of course, distant but, nevertheless, fully feasible. There will be difficulties encountered, no doubt, yet I am confident there will be no obstacles which could not be overcome. The time necessary for complete success will depend largely on the interest and support the work will be given.

IV.—The plans of procedure of the department on the above basis are as follows:

The first part of the entire aim, the investigations on the living population of the State of New York, is of necessity an extensive matter. Reduced to mathematical terms, the task amounts to about this: There are to be

examined, from every point of view, about forty thousand individuals—about thirty-five thousand insane and other abnormal people, and several thousand of the healthy and sane. And there is to be made a complete scientific analysis of the results of all these examinations. Nothing definite and authentic could ever be established on any considerably smaller number of facts, for reasons on which I can not dilate for the present.

One single thorough examination requires at least half a day. Under no circumstances could more than seven hundred such examinations be made in a year by a single observer, no matter how experienced he may be. Following at that rate, it would take one man about sixty years just to collect his data—a circumstance which clearly points to the first of the important conditions of success of the whole undertaking, namely, that the one who starts the work must secure assistants. Should any one have to go ahead with the work alone, his whole life would not suffice for its accomplishment and it would never bring the full results. The work conducted by myself, unaided, could never be finished. But let me, in each of the great institutions I shall visit, inspire one or two of the staff with the importance and the interest of the undertaking, and help these fellow-students, in every possible way I may be able, to become the followers of our aim, to become my associates in the work, and what could not have been accomplished in half a century with all possible exertion, will become a comparatively easy work of ten, or at most a dozen years. To have a body of able and energetic fellow-anthropologists is the vital condition of success for this department, and hence it will be in this direction that I shall exert my first efforts.

The next most important practical step will be the arrangement of the work.

It will be necessary in many instances of the normal and in some cases of the abnormal individuals to proceed with the entire examination at once. There are cases of insanity which are of too brief duration to allow of much

delay and of too infrequent occurrence or recurrence to allow the hope that the various phases of a particular kind of disorder could be ascertained on a sufficient number of different individuals. All the criminals must be subjected to the whole examination at once, for reasons which will be discussed in a special paper. And there will certainly occur cases outside of the institutions which may be obtainable but once, which will also prove to be the case with certain normal individuals. In all these instances we shall be obliged to secure the entire information perhaps in one session. In the majority of abnormal cases, however, and particularly so in the insane, such a very comprehensive procedure would not be the most advantageous. The long examination would tire the patient and correspondingly diminish the value of his statements. It would also tire the examiner, and thus blunt somewhat the intellectual freshness and acumen which are so necessary to a fully successful investigation of a case. Besides this, a long time would still necessarily elapse, under those circumstances, between the beginning of the work and its final literary reduction; moreover, at the completion of the examinations, there would be a sudden, great accumulation of the data obtained, a condition which would render any analysis very difficult, if not impossible.

Taking all the above into consideration, it will be seen that the better plan will be to divide the whole procedure into sections; to proceed with each section until it be fully completed and elaborated; and in the end to bring the elaborated sections together, analyze them and convert the partial data into the final results.

By proceeding thus, we need not fear that we shall endure any great loss in the unity of the investigations. The value of the results would suffer only then, should we deal with small numbers of cases; in examining such large numbers as shall be at our disposal, we neutralize and overcome individual variations, and deal with almost pure, almost abstract conditions. We shall not obtain all the

data of our scheme on one person always, but, operating on large masses, we can be certain of obtaining the whole set of data in the same phases of our subjects. Our results shall be the averages of whole classes of human beings; and as all well-defined classes are well nigh constant in their characters and change but very little with time, and as irregularities of individuals are reduced to a minimum when large numbers are considered, our investigations will bring out the class-characters, even though it may be from different persons of the same classes of people.

V.—The basis of the investigations is a scheme of examination on which the writer has worked both theoretically and practically for several years and which will cover every important group of points within the scopes of the normal and of the abnormal individual of our races and color in this country. This scheme is divided into the informative, or anamnestic part, and the more purely objective examinations. It embraces mainly facts of anatomical, physiological, psychological and sociological orders.

The field of work comprises: (1) Most of the State and some of the County Institutions, which establishments will yield us most of the abnormal and at the same time some of the best, in many respects, normal material (employees); (2) the laboratory, which may reach certain abnormal classes outside of the institutions (perverts, for example) and will also secure some normal people, and which moreover will be also the school, the place of elaboration of all the data, and the receptacle of all store material (specimens); and, (3) various ordinary asylums (for orphans, aged, etc.), military and other organizations and societies, and perhaps some ordinary hospitals, which will supply us with most of the normal subjects for our investigation.

The field and lines of work having been outlined, there remains only the definite method of procedure to be considered. Reasons were given in the foregoing section of

this article why a general complete examination would not be advisable. For those reasons, the whole scheme of examination will be divided into groups of points, each group being calculated to be sufficiently harmonious to bring out some salient facts, and not to require for collection more than half an hour with each individual. This done, the practical work will immediately be started. I trust it shall be my privilege to visit institution after institution and conduct the investigations in person. Wherever one or more members of the medical staff can be interested in the work, and I firmly hope this will be generally the case, I shall initiate the procedure and entrust the physicians with the continuation. I shall give sufficient time to the initiation in each case, until an assurance of a homogeneity of work has been founded and the personal equations of the investigators have been brought down to the minimum. Full printed blanks will be supplied for all the records. When filled, these blanks will be returned to the Pathological Institute, and work will be started on another group of data. When all the data of one order are together, they will be elaborated into a conjoint article—an article bearing in title the name of every investigator concerned in the collection of the facts. And all such articles will be published in the STATE HOSPITALS BULLETIN.

Two of the most important of the groups above referred to require a few words in special: they comprise the anthropometric and particularly the cephalometric investigations. These two classes of examinations are bound to play a certain rôle in diagnosis and prognosis in future, and our perusal of them will in no small measure determine how great their rôle is to be. But these anthropometric manipulations are rather extensive and require knowledge of special instruments and great precision and homogeneity of execution. No single man could undertake them on all these thousands of cases which are to be examined. Here it will be an absolute necessity for me to have several associates. Being once sure of these, I

shall have to arrange for them a course of practical instruction in measuring and in what is most closely related to the same at the laboratory, a course of at least four weeks' duration. Without such course of instruction, and, I may add, without the use of the same kind of instruments and the same methods, no uniformity and consequently no association and combination of anthropometric or cephalometric work is possible. Such an object, however, as arranging a course of instruction at the Institute, can not be contemplated before I have found my associates, and before some results of the work of the department are shown and the department itself has gained a full and general confidence—all conditions possible only later. For these reasons, both these groups, measurements of the body and those of the head, whatever be their importance and whatever may be the interest manifested in their behalf, can not be applied for the present. When their time comes, and that I think will be before long, every institution in which an able coöperator will be found will be furnished with a set of the necessary instruments, compared and tested at the laboratory. At the same time the proper and sufficient course of instruction and demonstrations will be given to those who would undertake this work. And only then will every one of those concerned in this work feel with me that he is starting fully prepared with these important groups, and that his individual work as well as the combined efforts of all shall be of lasting value. It seemed to me that these last few phrases were necessary to guard against impatience and unsystematic work in this direction.

VI.— A few words are advisable in concluding this general and brief outline of the work of the Department of Anthropology.

The work organized as proposed above will be steady and fruitful from the first. Its nature once well recognized, it will attract worthy and faithful followers wherever started. The advantages of the investigations will be both immediate and remote, particularly in regard to the insane

and the criminals. As one of the immediate advantages, I need only mention the scientific stimulus which the work will exert generally, and especially the promotion of direct scrutiny and precise knowledge of the patients in the hospitals. Among the more remote results, there will be the collections and the array of important data gathered with such thoroughness and in such extent and numbers that they not only will exceed anything done along these lines before but may stay unique for long years to come. Such data and the deductions from the same are sure to be soon followed by important practical results, which will benefit, and certainly help much to define, the various abnormal classes. The Institute, which has been the source of such investigations, besides others of no less importance, shall have proven itself thus worthy of the expectations of its originators and supporters, justify the expenditure for its maintenance, and may become an example to many other similar institutions. And there is no doubt but that our whole present systems of alienation, criminality, *et sim.*, shall gain by these studies both in scientific prestige and elevation.

PART II.

I.—Having presented the general outline of the proposed work of the Department of Anthropology of the State Pathological Institute, it remains for me to point out with more detail a few of the first requisitions of the department.

I have stated briefly the two main classes of procedure, namely, the investigations on the living, and the collection of important specimen-material. It will be best for both these functions to go ahead simultaneously, which can be accomplished without the interference of the one with the other. While the examinations are proceeding in the various institutions, there can progress at the same time an influx of interesting specimens, which, by the time the studies on the living are finished, can amount to a large nucleus of a valuable anthropological museum, full

of sources of further investigations. This matter of collecting specimens for future research is of such consequence that it needs a little detailed consideration.

There is hardly a week wherein an opportunity for an autopsy would not present itself at some one of the State hospitals; and there is not a single post-mortem examination that might not yield something of anthropological interest. If such a part be found, all that is required is that it be secured with care, and sent, with full information regarding it and its owner, to the Institute, which will take all the necessary care of it subsequently.

There are several things of particular value, but above all it is the brains of the abnormal classes that we want, for one of the future duties of the anthropologist is to determine whether or not, and how, the brains of the insane, the criminal, etc., differ structurally from the normal. We want all the brains, at least all those left after the requirements of pathological research have been satisfied, without discrimination or limit in numbers. Next after the brain, come the anomalies of the various other organs.

A certain method is necessary in securing a part for the purposes of anthropology, and I may briefly give it:

Having the body, register any marked abnormality you may find on it. Measure always the length of the body. Should something very remarkable be found, it ought to be secured by photograph or drawing.

To obtain the brain, open the skull carefully so as not to injure the contents. Take the brain out with the membranes, let it stand five minutes in order that the liquids may exude to a certain extent, and then weigh the organ with the soft membranes attached. You may examine the brain then in a general way for your own purposes; and if you find you do not require it for any special microscopical study, and you wish to transmit it to the anthropological collection at the Institute, proceed as follows: Secure a large, clean, ordinary bowl, and put the brain in it, convexity downward, and in such a way that the various parts lie as much

as possible in a natural position. The bowl is best covered with a sheet of rubber tissue. If it be winter and the weather cold, the specimen can be transmitted in the fresh condition, which is always the most desirable. In such a case put the bowl with the brain in it into an ordinary cheap tin kettle, large enough to accommodate the bowl, with some cotton, to diminish concussions, placed underneath and above. When the weather is too warm and does not permit of this course, put the brain into a zinc, tin, or glass jar, with some cotton on all sides, and saturate and cover everything with a mixture of 97 parts of alcohol and three parts of strong formaline. Every specimen should be directed for *immediate* transmission, and must be accompanied with a few most important data as to the nature of the case; these data direct largely the methods of disposal of the brains at the laboratory and should never be omitted or delayed. A complete history of the case and of the autopsy can be transmitted a day or two later. As to the vessels in which brains are sent, they should not compress the brain, nor be again too spacious; the best vessels are of zinc with a screw top; they will be furnished on application by the Institute.

An effort to measure the liquids may be made, but guard against their having become admixed with blood.

All forms of anomalies of external and internal organs are of importance to the anthropologist; only care is necessary not to include that which is accidental or due to a disease. Disproportions between the various segments of the limbs ought to be measured and a record of them sent to the Institute. There may be found supernumerary, misplaced or wanting digits or breasts; deformities of the genital organs; or peculiarities of some of the viscera, and they are all desirable for the collections at the Institute. When abnormal hairiness exists, the part of the skin bearing such, unless too large, should be excised; and the same should be done with various cuticular appendages; *nævi*, birthspots and the like. If an anomaly can not be secured as such, a cast of it is the next most desirable.

A full description, and where possible an illustration of the part as viewed *in situ*, should in every case be secured and follow every sending, with the hospital number of the subject and the main particulars of the case.

All organs, with the exception in the case of the brain mentioned above, should be laid in alcohol before transmission. When skin only is concerned, stretch the part evenly on a little wooden frame or on a board, pin it there, allow it to dry completely in the sun and transmit thus.

II.—After an autopsy has been completed and every interesting soft part has been studied or removed, there still remains a great deal of anthropological importance, and that is the skeleton. No tissue of the body bears so many abnormal marks as the osseous. But there is also no other part of the body which is so difficult to obtain.

There is every reason to believe that, if sufficient numbers of skeletons of the abnormal classes could ever be secured, their scientific value would well repay the trouble incurred in the process of collection. This fact is felt deeply by every anthropologist and criminologist, but the difficulty has been always how to obtain sufficient numbers of *known*, well identified skeletons.

Several European collections contain numbers of skulls of the insane and the criminals (Broca's, Welcker's, Zuckerkandel's, Virchow's, and several Italian), but the majority of these skulls are only badly or not at all identified, and there are but few entire skeletons. Recently the French have been making some efforts in this line and are endeavoring to obtain some identified remains of certain classes of people. Within the last two years excavations of old graves have been conducted at Bicêtre, and they furnished this great hospital with a few recognized epileptic skeletons, which, in the appreciation of the scientists of that hospital, doubled the previous value of its museum.

Under these circumstances, it is, I think, easily and absolutely demonstrable, that an institution, which could produce a collection of a large number of skeletons of

insane, epileptics, idiots, and allied persons, duly classified according to the cause and nature of the affliction and supplemented in each individual case by an *authentic history of the patient*, would thereby produce the most valuable and unique collection in existence, such a collection as would be justly the pride of every one instrumental in its formation. It would redound to the credit of the Institute and would be a point of honor and of home and even foreign admiration. And it is just such a collection that becomes now, when there is a proper place and the proper hands ready for it, comparatively easy and feasible.

Many of the patients who die in State hospitals are friendless or paupers, and have to be buried at a comparatively large expense to the State. Such a burial, the Secretary of the Commission in Lunacy kindly informs me, averages in each case about \$12. The body is usually given to an undertaker and he disposes of it according to his best convenience. In some instances a medical college secures the cadaver, instead of an undertaker. The fact is, that after such a body is removed from the hospital it is never any more heard of. This procedure is covered by a law, which reads as follows:

CHAPTER 661, LAWS 1893.

Sec. 207. CADAVERS. "The persons having lawful control and management of any hospital; prison, asylum, morgue or other receptacle for corpses not interred, and every undertaker or other person having in his lawful possession any such corpse for keeping or burial may deliver and he is required to deliver, under the conditions specified in this section, every such corpse in their or his possession, charge, custody or control, not placed therein by relatives or friends, in the usual manner for keeping or burial, to the Medical Colleges of the State authorized by law to confer the degree of Doctor of medicine and to any university of the State having a medical preparatory course of instruction and the professors and teachers in every such college or university may receive any such corpse and use it for the purpose of medical study. No corpse shall be so delivered or received if desired for interment by relatives or friends within forty-eight hours after death, or if known to have relatives or friends; or of a person who shall have expressed a desire in his last illness that his body be interred, but the same shall be buried in the usual manner. If the

remains of any person so delivered or received shall be subsequently claimed by any relative or friend, they shall be given up to such a relative or friend for interment. Any person claiming any corpse or remains for interment as provided in this section may be required by the persons, college, university or officer or agent thereof, in whose possession, charge or custody the same may be to present an affidavit stating that he is such relative or friend, and the facts and circumstances upon which the claim that he is such relative or friend is based, the expense of which affidavit shall be paid by the persons requiring it. If such person shall refuse to make such affidavit, such corpse or remains shall not be delivered to him but he shall forfeit his claim and right to the same. Any such medical college or university desiring to avail itself of the provisions of this section shall notify such persons having the control and management of the institutions and places heretofore specified, and such undertakers and other persons having any such corpse in their possession, custody or control in the county where such college or university is situated, and in any adjoining county in which no medical college is situated, of such desire, and thereafter all such persons shall notify the proper officers of such college or university whenever there is any corpse in their possession, custody or control, which may be delivered to a medical college or university under this section, and shall deliver the same to such college or university. If two or more medical colleges located in one county are entitled to receive corpses from the same county or adjoining counties, they shall receive the same in proportion to the number of matriculated students in each college. The professors and teachers in every college or university receiving any corpse under this section shall dispose of the remains thereof, after they have served the purposes of medical science and study, in accordance with the regulations of the local board of health where the college or university is situated. Every person neglecting to comply with or violating any provision of this section, shall forfeit to the local board of health where such non-compliance or violation occurred, the sum of twenty-five dollars for every such non-compliance or violation, to be sued for by the health officer of such place, and when recovered to be paid over, less the costs and expenses of the action, to such board for its use and benefit."

Some of the State institutions—and there is quite a fair percentage of such, as I had an opportunity recently personally to ascertain—have their own, or at least partly their own, burial grounds. In other cases the bodies of the unclaimed are given to undertakers and buried usually with other paupers in some part of a general cemetery. In most instances, wherever the burying takes place, the

remains, even if not mixed with those of other classes, are in a few years beyond any possibility of identification. And it is in this way that we are continually losing invaluable material.

When traveling over Europe and visiting many of the insane hospitals, I found almost regularly that a graveyard was attached to each one, where at a minimum expense and without any disadvantage whatever, are buried not only the friendless and paupers, but many other deceased inmates, those for instance, whose friends are far distant and wish to obviate the trouble of transportation, or those whose friends have not enough money to spare for a regular funeral. The cost of this kind of burying is very little. The graveyard is a somewhat out of the way and mostly otherwise useless corner; it is surmounted by trees usually, and presents nothing dismal in appearance. A number of carpenters, selected usually from among the patients, works at the simple cases for the bodies; and two or three other men have the office of grave diggers. The entire expense of the funeral is the box wood, and the whole procedure involves no more trouble than with us an ordinary removal of a dead body from the hospital.

If such a mode of burial of the friendless and unclaimed were followed with us, the science of anthropology would soon be a great gainer thereby. It is from these kinds of cemeteries, conducted with the scientific purpose in view, that we could obtain after a period of from four to six years a continuous supply of identified sets of bones for our collections.

We ought to follow the European example in this particular matter of special graveyards. The economy of such a disposal of the friendless is beyond question, and so is, also, I think, the fitness of the method. But we could greatly improve on the European plan, having our special object in view, for very little scientific utilization of the cemeteries has been attempted in Europe outside of the above mentioned Bicêtre.

So much said for explanation, I venture with a propo-

sition, which is that an effort should be made for all such rules or laws as would make possible (1) the establishing of private burying grounds for each State institution for the abnormal classes; and (2) the exhumation, after a certain time, of the osseous remains of the unclaimed bodies, for the purposes of anthropology.

I can think of no material obstacle to this proposition of mine. If land be wanting, it can be provided with little expenditure—an acre or two of sandy or fairly dry place will do forever. The few institutions in or very near large cities may be excluded.

Should a special law be necessary, the legislature could no doubt be made to understand the value and importance of such an amendment and find its use.* The State will save by the new plan of burial. The individual hospitals will be subjected to no more trouble than the care of an additional little lawn or garden. Should any objections be raised against the manufacture of coffins by the patients, they can be made in prisons. And all that will be required for the purpose of science will be to mark the grave sufficiently for an unmistakable recognition in the future. The time of exhumation will come in from four to six years, according to the soil, and will be undertaken by the Anthropological Department of the Institute. Those institutions which already have their own burying grounds would be subjected to but very little additional trouble regarding the identification. . .

The preceding propositions will be sufficient for a good beginning of the work of the department, and I conclude with them the brief exposition of the task of Anthropology in connection with the Pathological Institute.

* Since the above was written, a draft of such amendment has been submitted to the State Commission in Lunacy for presentation to the legislature.

A CLINICAL* REPORT OF THREE CASES OF UNCOMMON NERVOUS AFFECTIONS OCCURRING AMONG THE INSANE.

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I.—*Convulsive Tic with Copro- and Echo-lalia.*

Habit spasms and irregular or co-ordinated choreiform movements are frequently manifestations of a neurotic diathesis or indices to a mental abnormality. In the "*maladie des tics convulsifs*" there exists, according to Gilles de la Tourette—who described several cases under this title, and by whose name the disorder is also known,—a disease in which a liability to paroxysms of spasmodic movements of various portions of the body is always associated with a mental disorder—a mental disorder, characterized by an uncontrollable impulse to utter obscene words with each spasmodic attack. The term "coprolalia" was applied to this impulse by Tourette, who, however, includes it with the spasmodic phenomena under the single title of "*tic convulsif*." Conversely, the word "coprolalia" is sometimes employed, metonymically, to designate the entire affection. It would seem wisest to use these expressions as indicating the symptoms to which their etymology refers them, and to represent the combination of intermittent spasms and explosive obscenity by a combination of the terms: "convulsive tic with coprolalia."

Limiting the applications of the words according to this idea, and modifying from various descriptions, *convulsive tic with coprolalia* may be defined as a "*chronic, remittent, paroxysmal and usually incurable*"‡ *malady, most often developing in male children of hereditary neuropathic diathesis or neurotic family history, and marked by paroxysms of*

*None of these cases has come to necropsy.

†Resigned December 17, 1896.

‡Régis: A Practical Manual of Mental Medicine, Utica, 1894, p. 276.

“apparently purposive actions,” or, more frequently, by sudden, involuntary, co-ordinated spasms of groups of muscles, either in the face alone or in several parts of the body; the convulsive seizures being frequently accompanied by uncontrollable impulses, which latter are represented by the explosive utterance of obscene or profane words (coprolalia, coprolalia), sometimes also by the repetition of some word or words just heard (echolalia), or by the mimicking of some action (echokinesis), or by the utterance of whatever thought may be on the mind (tic de pensée); these symptoms being occasionally associated with obsessions (e. g. arithmomania†);—the whole disease “being really a psychosis allied to hysteria, though in certain of its aspects it has the features of monomania.”‡*

Despite its well-defined symptoms, this disease has not yet found its recognized place in the category of nervous affections. Hirt§ mentions it as a facial spasm, (mimic spasm, histrionic spasm, *tic non douloureux*), and suggests that the cases reported by Tourette, Dana, and Wilkin may be due to stimulation of the face and speech centers in the cortex. Philip Coombs Knapp, in his translation of Strümpell's text-book of medicine,¶ recognizes the neuro-pathic element in convulsive tic with coprolalia, yet describes the latter in the chapter on localized spasms.

Osler** discusses it with the “habit choreas,” and separates it from the disorder of the Maine “jumpers,” the Malay “lata (h)” and the Siberian “miryachit.” Dana†† considers all these as “spasmodic tics,” and H. C. Wood‡‡ describes them together as forms of “automatic chorea.” Régis,§§ quoting from Charcot that “the tic. is, on the one side, a psychic disease, for there are mental as well as bodily tics,” deals with the malady as a degeneracy of evolution, a neuropathy, an obsession-propension.

*H. C. Wood in Pepper's System of Medicine, Vol. I, p. 635.

†As in the young girl referred to by Osler; Practice of Medicine, 1st ed., p. 943.

‡Ibid.

§Dis. of Nerv. Syst., 1894, p. 78.

¶Second American ed., p. 573.

**Op. Cit.

††Text Book of Nerv. Dis., p. 431.

‡‡Op. Cit.

§§Op. Cit., p. 276.

That spasmodic tics with coprolalia, echolalia and *tics de pensée* can constitute the chief clinical features in a well-developed mental alienation, is illustrated in the following history:

CASE No. 2087.—E. M., male; age 57; married; nativity, Ireland; of parents, Ireland; alcohol habit; education, reads only

Family history very defective. Father died of consumption at age of 50, (patient was then 7). Mother died in childbirth when patient was two years old. Three sisters and four brothers, all now dead but one brother. Two sisters died in childhood; one brother died of scarlet fever when 30. Patient can give no history of nervous affections in either ancestral or collateral relatives, but admits that he remembers little of his parents and nothing of his grandparents.

Of his earlier personal history Mr. M. gives the following facts: When 9 years old he was taken from school to work on a farm. He continued as a farm laborer for several years. Had scarlet fever when 20. When 21 he came to America, where he employed himself as a farm hand, later as a longshoreman (for three and a half years), subsequently as an iron driller. He married when 26; has seven children, the oldest 31, "all alive and healthy." The patient's account of the commencement of his nervous affection is confused. He denies having been in the Oneida County House, as stated in the case book.

He was committed to the Hudson River State Hospital in July, 1890. There it was recorded that "upon admission patient was restless and emotional; contorts his face, jerks his neck, stamps his feet and claims that the priests make him do so. Very incoherent, confused, and delusional. From time to time he is noted as looking like a dog, striking himself and bruising himself. Has hallucinations of sight and hearing," and again, in October, 1893, patient showed "no essential change; continues to strike his head against objects, contort his face and throw himself about. Confused. Refuses to work. Careless. Untidy. Harmless. Fair bodily health." On November 3, 1893, patient was admitted to the Rome Temporary State Hospital, where he remained, without mental or physical change, until May 9, 1894. Was then removed to the Utica State Hospital. There his record showed a continuance of the same clinical manifestations, and a persistence of the same persecutory delusions (*vide infra*.)

Transferred to the St. Lawrence State Hospital June 3, 1895. "On admission patient made sudden motions and sounds, protesting that a priest made him do so." "Physical condition strong. Pulse, 88; arteries thickened. Tongue coated. Eyes dark. Coherent; answers questions. Diagnosis, chronic mania; alleged cause, fright." August 8, 1895, "Patient continues to think that he is possessed of a spirit which was put into him by a priest. Makes noises and movements

with arms and body, and says these are caused by the spirit, and that the priest does this to torment him. Fair physical health, but does not work." November 16, 1895, "Above mentioned delusions remain. Says he refused request of a priest to put a \$300 memorial window in a church, hence he is thus persecuted. Eats sparingly, frequently regurgitates his food in obedience to his delusions." March 16, 1896, "Stomach disorder improved. Continues to contort himself and make strange noises."

Present Condition.—On the ward, Mr. M. is usually to be found in one of two postures.* When the attendants allow him that privilege, he lies on a bench, with head thrown forward, legs crossed and hands (as at all times) in his pockets. Usually, however, he sits on a chair in the characteristic attitude which the accompanying photograph depicts. The head is inclined to the right side and tilted forward, the chin resting on the chest. The forehead, transversely wrinkled; the heavy brows, contracted; the dark, questioning eyes, cast down; the thick lips, parted; the corners of the mouth, drawn, as if from long suffering; the naso-labial folds, deeply cut; the jaw, fallen—all make up "a specially marked stamp of physiognomy, which has been fashioned by the mood-marking muscles of facial expression."† The trunk, like the neck, is somewhat flexed and the shoulders droop. The elbows, wrists and fingers are likewise in a position of flexion and the hands are thrust deeply into the trousers pockets. One leg is thrown over the other.

In this lounging position the patient sits in the intervals between the convulsive seizures, and into it he relapses as soon as the brief paroxysms are over. Sometimes he walks nervously about the ward, muttering to himself. He pays no attention to his fellow-patients. He is entirely absorbed in his own troubles and in his mental conflict with the evil spirit which, he claims, has so complete a mastery over him. He answers questions readily, however, and his conversation is coherent and free from the obscenity which "the spirit forces from him against his will and sense of decency." While talking, he exhibits a fine tremor of the head and a spasmodic raising and lowering of the eyebrows. His memory is fairly good.

The convulsive seizures are as frequent as they are sudden and brief—the inter-paroxysmal periods being measured in seconds or minutes. The tic may consist in a contortion of the face alone, or also of a violent shaking of the head to one side or posteriorly, accompanying the grimace; usually, however, the spasm is more general—the face is contorted, the head twisted to one side and the legs thrown in the air or stamped on the floor. Sometimes the entire

* "Postures are the results of movements and for that reason they have the same physiological significance as movements; that is, postures are nerve-muscular signs."—Francis Warner, "Physical Expression."

† Henry Maudsley.

body is thrown forward with considerable violence. The arms are not as often convulsed as the head or the legs. When asked whether or not the spirit ever works on his arms, Mr. M. will have an entirely voluntary spasm, (a poor imitation of the involuntary tic), in which the arms play the most important rôle; at the same time he will say—"Look at that. He can do anything he wants with me. He shakes every part of my body; he pounds on my insides; he won't let me work. I have no control over myself at all, etc."

The tic ceases as suddenly as it appears, and leaves the patient as outwardly calm as before. Abrupt, violent, brief—the spasm might aptly be styled "electrical;" but that term has been employed to designate another variety of convulsive movement.

Accompanying the tic is its clinical twin—the involuntary utterance of various sounds. Usually this takes the form of a word, a few words, or a short sentence, apparently according as the tic itself involves a small area or is more widely distributed over the body. The first word is pronounced loud and explosively, the following words are usually not as distinct. The words are apt to be obscene or profane (coprolalia), but they are not always so. Sometimes the sentences uttered are those which "the spirit" addresses to Mr. M., e. g.: "You can't get rid of me;" sometimes, they are words addressed to "the spirit," by the patient, e. g.: "Let me go to my family." (*Tic de pensée*). Instead of words the explosion may take the form of a metallic, throaty sound like "Ahem!" (resembling laryngeal chorea). A sudden exclamation made in his hearing is instantly repeated by the patient, accompanied by a convulsive seizure (echolalia). There has been noticed, however, no mimicking of others' actions (echokinesis).

At his meals Mr. M. bolts his food, unchewed, in large pieces; he swallows his portion of butter in one mouthful and disposes of bread, meat or eggs with corresponding rapidity. He consumes five minutes or less at the table, and then returns to his usual position in the day-room. Shortly thereafter he begins to vomit, little by little, the meal which he has just swallowed. The first portions of food thus regurgitated are so little digested that they taste, so the patient says, much the same as when originally ingested. This strange emesis is continued over the greater part of the interprandial hours. It causes the patient but little discomfort and usually is produced without effort. The phenomenon suggests the possibility of a gastric (and diaphragmatic?) spasm similar to the convulsive tics. The ward attendants state that when the vomiting does not promptly appear of itself, the patient kneads his abdomen with his fists to produce it. As with his other symptoms, the vomiting is referred by Mr. M. to the malicious working of "the spirit" resident within him. Although there is no indication of intestinal disorder, he goes to the water-section several times a day: "The spirit works on my bowels all the time. He pulls my vitals and throws the food off my stomach."

When questioned, Mr. M. always repeats, in substantially the same form, the delusion that a priest infested him with this evil spirit because he refused to denote a \$300 memorial window to the church. In addition, the patient appears to suffer from hallucinations of sight, hearing, touch (and, perhaps, of taste) for his tormentor "appears to him at night, talks to him, scratches him," etc.

Physical Examination.—Good physical development. Fair nutrition, but anæmic.

Measurements.—Height 171 cm.; shoulders in proportion; upper extremities, 67.5 cm.; lower extremities, 77.5 cm.; chest, 85 cm.

Cranial Dimensions.—Circumference, 57 cm., antero-post. diam., 19.5 cm., bi-parietal diam., 15 cm.; cervico-bregmatic diam., 18 cm.

Facial Dimensions.—Bizygomatic diam., 12.5 cm.; fronto-mental diam., 19.5 cm.; glabello-mental diam., 13 cm.; between inner canthi of eyes, 3.6 cm. Cephalic index, 74.36; facial index, 64.1. Circumference of neck, 36 cm. The facial expression has been mentioned above. Forehead, broad; malar bones, prominent; eyebrows, black and heavy; irides, brown; palpebral fissures, relatively narrow; nose, long; nasal septum presents a spur surmounting a curvature to the left; beard, red sprinkled with gray. Ears, moderate in size; normally implanted; helices, broad, flat; fossæ scaphoideæ, narrow and in right ear obliterated inferiorly; tragi, small; lobules, adherent, especially on right side.

Oroscopy.—Lips are thick and parted (patient is chiefly a mouth-breather); teeth, irregular; tongue, normal; palate, moderately high-arched, no ridge; uvula, short; velum and fauces, normal.

*Laryngoscopy.**—Larynx large and pomum Adami prominent; epiglottis, large, symmetrical, hyperæmic; false cords, swollen; true cords, right, congested, motility diminished; left, normal; apposition, fair; aryteno-epiglottic folds very thin; pyriform fossæ, deep; tracheal rings, plainly visible.

Posterior Rhinoscopy.—Left naris much contracted by curvature of septum.

Ophthalmoscopy.—Marked hypermetropia in both eyes; fundi, normal.

The Trunk.—Droop of shoulders has been referred to; left shoulder somewhat higher than right because of slight dorsal lævo-scoliosis; compensatory lumbar dextroscoliosis; gait, shambling, with moderate inclination of body to right side. Thorax: Dulness at both lung apices but no corresponding rational symptoms; heart area, normal; pulse, 84, and irregular; first sound, blowing—slight aortic stenosis.

Abdomen.—Liver dulness extends, in mammary line, from 6th costal cartilage to one inch below free border of ribs. Stomach area, dull. Genitals, normal.

* One of a series of cases examined with a view to studying the larynx of degenerates.

CASE No. 2087 Convulsive Tic with Coprolalia,

CASE No. 2087. Convulsive Tic.

Extremities.—Normal.

Motility.—Muscular strength everywhere good. Electrical reactions, normal. Reflexes—patellar, almost absent, slight jerk elicited by “reinforcing;” wrist jerks, moderate; pupillary reactions to light and accommodation rather sluggish, consensual and sympathetic reflexes, fair.

Sensibility.—Normal to all tests. No areas of anæsthesia nor of hyperæsthesia (no globus hystericus, nor headaches, but head sometimes feels numb). No “reflex cause” for the spasms can be found.

Urine contains a trace of albumen, numerous calcium oxalate crystals, a few leucocytes. Hæmoglobin, 75 per cent.

II.—*Simple Senile Paraplegia.*

Gowers* describes, under this title, cases of gradually developing and slowly progressive simple weakness of the legs, occurring late in life (after 40, usually after 50), and characterized by stiffness and slowness of movement without wasting, sensory disturbances or reflex alteration.

The following is such a case:

No. 2458.—J. T., male, admitted April 29, 1896; senile dementia. Age, 86; widowed; six children; youngest age 53, four living; by occupation, a builder; nativity, England; of parents, England. Family history, negative—no insane relatives. Used alcohol and tobacco excessively. Common school education.

History Previous to Admission.—Mental condition had been developing gradually for ten years, coincident with the progress of a “partial paralysis.” Had become quite feeble but until recently got about with the aid of two canes. Memory very poor. Would wander about the street and lose his way. Made threats; attempted injury to members of his family. Imagined he was fighting with some boys nearly all the time; imagined he was teaching school. Sleepless; cried “murder” at night; thought someone was trying to kill him; tore clothing and bedding.

On Admission.—Garrulous, voluble, but coherent; easily provoked. Did not appreciate surroundings. Large frame; development and nutrition, fair. Senility well advanced. Hair, gray. Toothless. Eyes, blue; reacted fairly well to light, poorly to accommodation; pupils contracted. Lungs, expansion, excellent; respiratory murmur, good. Circulation.—Heart, hypertrophied; sounds scarcely audible; apex impaction feeble; pulse 80. Arteries atheromatous; arterioles of face dilated. Circulation in extremities very poor. Tongue coated; bowels constipated; appetite good. Gait feeble and paralytic. Temperature, 96° F. Weight, 137.

**Diseases of the Nervous System*, 1895. Vol. I. p. 470. “*Centralblatt für Nervenkrankheiten*,” 1890.

Subsequent History.—Remained in bed because of paralysis, which slowly increased. Physical health gradually failed. Dementia progressed. Unappreciative, resistive, restless, sometimes noisy. Would fall out of bed. Illusional. Failed to recognize his son. Symptoms of chronic nephritis with exudation. As examined from time to time, urine was yellowish-red to red, in color; odor, normal; sp. gr., 1.015-1.020; reaction, acid; albumen in variable quantity; urea 1.2 per cent to 2.1 per cent; granular casts; leucocytes; sometimes red blood corpuscles. On November 10, urine was alkaline and contained bacteria.

On June 2d Mr. T. developed a mild gastritis. Inflammation spread to duodenum, producing enlargement of the liver and icterus. At various intervals, thereafter, the patient had attacks of catarrhal jaundice, with constipation and febrile elevation of two to four degrees F., sometimes with vomiting. Such attacks were usually aborted promptly by castor oil. They became more frequent and more obstinate, however, towards end of October, by which time Mr. T. had become very helpless and very demented. On November 11, patient suddenly became worse, developed icterus, died. Autopsy refused.

Throughout the disease the paralysis was confined to the legs. No sensory symptoms could be elicited. At first Mr. T. was able to get about with some assistance. Latterly, however, his legs failed to offer him any support. Sensibility remained normal so far as ascertainable. Knee jerks were slightly exaggerated; no ankle clonus. Towards the end the muscles and skin became markedly atrophied, but equally so throughout the body, and not beyond what might be expected in a patient of such advanced age and debility.

An interesting symptom developing at this time was stiffness, contractures at the knees and hips, and rigidity of the trunk and neck. The combination of stiffness and weakness simulated that of paralysis agitans. As Gowers states it, "the condition of the legs resembles that in cases of paralysis agitans without tremor, in which the malady is manifested only by weakness and stiff, slow movements of the limbs, face and trunk," and, further, "this senile paraplegia is probably a partial development of the morbid process of that [Parkinson's] disease; instead of being general it is limited to the legs."

On the theory which he suggests, that paralysis agitans

may depend on changes in the motor cells of the cortex without secondary degenerations of the pyramidal fibres, this authority can readily reconcile "simple senile paraplegia" and shaking palsy pathologically, by conceiving that in the former affection the degeneration of the motor cortical cells is limited to the leg centres.

"Simple senile paraplegia" is rare in general practice. Perhaps, however, it is somewhat more common among such patients as Mr. T., with senile dementia and general enfeeblement. It must be admitted, too, that the dementia was probably largely responsible for the rigidity, and that the asthenia added to the motor weakness.

III.—*Ataxic Paraplegia.*

"Chronic spinal lesions are apt to overflow the tract from which they originally started or consentaneously to invade several portions of the cord. In this way arise atypical cases, offering during life contradictory symptoms of spinal disease."*

Sometimes the pathologist finds, in cases of locomotor ataxia, beginning or even advanced† degenerations in the lateral columns of the cord which gave little or no indications to the clinician. The microscopical findings in such cases have been reported by Pierret,‡ Westphal,§ and others. Conversely, symptoms of lateral sclerosis may obscure those of a (limited) co-existing posterior degeneration. Usually, however, when there exists a "combined sclerosis" of both lateral and posterior columns it manifests itself by a variable but fairly typical mixture of spastic-paretic and ataxic symptoms. Inherited, such a sclerosis is recognized in the form of "Friedreich's hereditary ataxia;" acquired, the lesion presents a morbid symptom-complex, to which Gowers aptly attaches the name "ataxic paraplegia."

*H. C. Wood in Pepper's System of Medicine, Vol. I, p. 793.

†e. g., a posterior sclerosis in the lumbar root zone will be marked by absence of knee-jerk despite the co-existence of a lateral sclerosis, as in Déjerine's case: Arch. de Physiol., November 15, 1884.

‡Arch. de Physiologie, Vol. IV, 1871-72.

§Arch. für Psychiatrie, Vols. VIII and IX, 1878-79. Summary of cases by J. A. Ormerod in "Brain," 1885, p. 110.

CASE No. 1721.—P. K., male; admitted to St. L. S. H. June 5th, 1894; dementia; age, 49; nativity, Ireland; of parents, Ireland; 39 years in U. S.; unmarried; sailor, then farmer. Drinks occasionally; chews tobacco. First attack; duration on admission, about seven months. Alleged cause, dissipation. Family history, negative; no insane relatives; no history of syphilis.* Accompanying disease, rheumatism. Has had malaria.

Medical certificate gives the only *history previous to admission*: "No memory for recent events. Said he could not drink; that his mind was in a whirl. Denied selling his interest in some property, when, in fact, he sold it some years ago and wasted the money." "Did nothing except in answer to questions. Held a piece of paper in his hands which he kept folding and unfolding, and crushing in a nervous manner." Exhibits a "vacancy, loss of interest in himself and surroundings. Filthy and slovenly in appearance. Somewhat emaciated. Unsteady in his walk. Had a silly laugh and appearance of dementia. Will not sleep in his room but prefers to sleep in the barn." "Sometimes will sleep all day and not come to his meals. Cross and ugly towards children."

On admission patient was quiet and dull. Memory for recent events very defective; could not tell the year or name of month. Physical condition strong. Weight, 150 pounds. Bowels, normal. Appetite, good. Eyes, blue; pupils, contracted. Tongue, tremulous. Speech, coherent. Gait, steady [?]. Heart sounds, rough; pulse, 69. Lungs, normal. Skin, filthy; pimples on body. General paralysis was suspected.

After admission patient worked in laundry for several months, although he was dull and complained, from time to time, that his head was "mixed up." On the ward he sat quietly in one place and spoke only in answer to questions. In February, 1895, his physical health began to fail and he discontinued the laundry work. In March, 1895, he was noted as being anæmic and physically weak. April, 1895, "Has been in bed two weeks with a mild febrile attack." November, 1895, "Is becoming very ataxic. Seldom speaks. Will stare at a newspaper for hours together." May, 1896, "Has been suffering from severe sore mouth, which has improved slowly."

Notes from an examination, July 27, 1896, (Dr. Somers): More or less ataxia in gait for over a year. Lately gait has been very ataxic, spastic, tottering. Walks with legs spread apart and knees stiff; feet drag along the ground; right leg (which appears to be the more affected) is swung around in a wide arc. Exhibits inability to turn around quickly, throws arms out as if seeking support. Romberg's symp-

*"History of syphilis rare," Gowers, Osler, Strumpell, Starr *versus* probably "many of these cases are really cases of spinal syphilis," L. C. Gray, *Mental and Nerv. Dis.*, 1893, p. 264. See also "Spinal Syphilis" in Wood's *Syph. of Nerv. System*.

tom well marked; gait wavering when eyes are closed. No girdle sensation or lightning pains. No disorder of special senses. Sensation, normal; localization of sensation, quick and accurate. Plantar and gluteal reflexes, normal. Only injury patient can recall is the one to his head (*vide infra*). No stigmata of degeneracy. Eyes, deeply set; vision, normal; reflex to light, good; to accommodation, sluggish.

On October 26, 1896, patient slipped and fell to the floor, striking on his right hip and producing an intracapsular fracture of the femur, which has since confined him to his bed. The existence of this injury added to the difficulties of the recent examination, detailed below, and, perhaps, subtracted from the entire accuracy of the data then obtained. On October 30, nine c. c. of cerebro-spinal fluid were withdrawn by lumbar puncture, with no ill-effect and no noticeable improvement.

Present Condition.—Patient is quiet, dull, somnolent, unappreciative of surroundings. He dozes much of the time, sometimes complains of feeling exhausted and easily tires after a brief examination. Memory for recent events lost; can not recall incidents three hours old; memory for early events, very poor—can give but little of his history, can not recall when he came to the hospital, nor how he injured his hip. Unable to concentrate his attention on any subject for more than a few minutes at a time. Rather childish.

There is a depressed scar over frontal bone, to the left of the middle line and just in front of the coronal suture. Scar is half an inch long, a quarter of an inch wide and an eighth of an inch deep. Patient says it is the result of a trauma inflicted in infancy.

General physical condition is fair; the muscles are somewhat flabby, however, and there is an ichthyosis simplex on forearms, legs and feet—more marked on the right side than on the left.

Examination of thorax and abdomen, negative. Pulse is slow, full, regular and of good tension. Slight arterial thickening. Bowels fairly regular; appetite good.

Examination of the right hip-joint under chloroform narcosis reveals bony crepitus at the neck of the femur. Top of right trochanter major is three-fourths of an inch above Nélaton's line with corresponding shortening of the limb. Hip and knee are semi-flexed and the extremity is abducted and rotated out. Extension of right thigh or leg produces marked flexor spasm and fibrillary twitchings in the calf. Attempts at walking bring on a corresponding clonic spasm whenever the right foot touches the ground.

Superficial Reflexes.—Plantar reflex, exaggerated; cremasteric and gluteal, normal; abdominal, "epigastric," "dorsal" and "lumbar," absent; "scapular,"* slight. A light blow on the cheeks pro-

*Gowers: *Diagnosis of Diseases of the Brain and Spinal Cord*. William Wood & Co. 1885, pp. 220 et seq. *Dis. of Nerv. Syst.*, 1895, Vol. I, pp. 14 and 15.

duces contractions of all the facial muscles (especially the levator menti), the platysmæ and the triceps cubiti.

*Deep Reflexes.**—The knee-jerks are markedly exaggerated, and may be demonstrated by very gentle taps. Ankle-clonus is pronounced on both sides, but Gowers' "front-tap contraction" can not be elicited. Tibiales antici muscles contract in response to a blow over their bellies. The deltoid, bicipital and tricipital reflexes are very pronounced and easily evoked. The deep reflexes of the forearm muscles are correspondingly exalted, notably the supinator-longus jerk; there is no wrist or finger-clonus, however. In the upper extremities the myotatic irritability is somewhat more pronounced on the right side than on the left. There is a moderate but distinct jaw-reflex. A fine tremor of the tongue may be noted, but there is no tremor of the face. Articulation is normal.

Electrical Tests.—There is no reaction of degeneration; but the responses to both galvanism and faradism are somewhat below the normal.

Muscular Power is moderately diminished in the lower extremities. The flexors of the wrists and fingers are feeble and the "grip" in the right hand is especially weak. There is no "cramp-like spasm on an attempt to use the hands." No muscular atrophy can be made out, beyond, perhaps, a slight wasting of the small muscles of the hands.

Ataxic Symptoms, as presented while walking, have been noted above. They are just as evident when the patient is recumbent (a diagnostic point on which Gowers lays much stress). Nor can the inco-ordination of movement in either the upper or the lower extremities be confounded with "intention tremors," which latter are entirely absent. The ataxia is easily demonstrated by the familiar tests; in the handwriting and in attempts to draw simple geometrical figures, it is characteristic.

Æsthesiometry.—No areas of anæsthesia can be found. Sensibility to light and to heavy pressure is normal and alike on both sides of the body. The localization of sensations is everywhere accurate. Examination, by means of Carroll's æsthesiometer, for the determination of distances on various parts of the body at which two points of contact must be apart in order to be separately recognized, gives contradictory results, largely attributable to the patient's incapacity to concentrate his attention, but, in general, it may be said that two points must be further apart than normal in order to be dissociated. On the tongue, however, at the finger tips, and over the thenar and hypothenar eminences, sensibility to touch is normal. Sharp points of contact are dissociated at shorter distances than are

* Compare schemes of localization of spinal reflexes, Peterson, N. Y. Med. Record, Nov. 12, 1892.

the sensations of blunt objects. Pain and temperature sensibilities, as determined by rough tests, are normal. There is no delay of sensibility, although, again, no accurate instruments were employed to determine this point. Hyperæsthesia, polyæsthesia, allochiria—are absent.

Except in the injured hip, the patient complains of no pains. Nor does he experience any tingling, numbness or other abnormal sensation.

The Eyes present no external abnormality other than a very slight ptosis of the right lid. No nystagmus. The pupils are unequally contracted; right, 3.5 mm.; left, 2.5 mm. They react fairly to light, better to accommodation; the consensual and sympathetic reflexes are normal. Irides, normal. Ophthalmoscopic examination gives the following results:* Hyperopic astigmatism of both eyes, more marked in the left; optic discs, round, with distinct margins and normal excavations; the right disc is a little congested; arteries, of good size, not tortuous, and present normal reflexes; veins, rather large in the right fundus, normal in the left; reflex from choroid, dark in the right eye, light in the left.

The cranial nerves are unaffected.

Analysis of the Urine on two successive days gives the following: First day, color milky; odor normal; reaction, acid; sp. gr., 1030; urea, 3.1 per cent; no albumen; no sugar; abundant amorphous urates; uric acid crystals; a few epithelial cells. Second day, color yellowish brown; odor normal; reaction, acid; sp. gr., 1024; urea, 2.7 per cent; no albumen; no sugar; bacteria, leucocytes, calcium oxalate crystals, vesical epithelium. There are no bladder symptoms. Sphincters unaffected.

In the slow progress of the disease and in the array of symptoms this case is much like the clinical type of a combined sclerosis. It is especially interesting, however, in that the lesion is extensive, and that both the ataxic and the spastic symptoms are distinctly developed and separately recognizable. The failure of memory which accompanies some cases of ataxic paraplegia† has become, in this patient, the most prominent feature of an advancing dementia.

It would seem that the spinal lesion and the mental affection began to manifest themselves at about the same time and have progressed hand in hand. The combination of psychic and somatic phenomena is suggestive.

* Confirmed by my colleague, Dr. Frank G. Hyde.

†Gowers' Dis. of Nerv. Syst., Vol. I, p. 455.

THE INSANITY OF TWO SISTERS.

By R. M. ELLIOTT, M. D.,
Medical Superintendent, Long Island State Hospital.

It is not uncommon to find in a public institution for the insane, with a population of five hundred or more, instances where two or more members of one family are under treatment at the same time. But it is extremely rare to find two members of a family committed on the same date, manifesting symptoms almost identical, and such a case is rendered all the more interesting when the symptoms are characterized by chronic and systematized delusions.

Dr. Peterson, in the *Alienist and Neurologist* of January, 1890, describes paranoia occurring in two sisters, where ideas of persecution developed simultaneously, and, later, hallucinations of hearing, taste and smell. Both had an eruption of acne on the face which was aggravated by picking and the use of wet cloths at night to prevent poisonous vapors entering their lungs.

The following is the history, so far as can be ascertained, and symptoms of two sisters who were admitted to the Long Island State Hospital on December 16th, 1895:

J. W., aged 75, widowed; no children; nativity, Scotland; occupation, housekeeper; habits, temperate; family history, negative; duration of attack, unknown. She left her home in Scotland about forty-five years ago for Melbourne, Australia, where she conducted a millinery establishment. After a residence of nearly twenty years there, she failed in business and came to America to join a sister who was living in Brooklyn, and the two have lived together constantly ever since, supporting themselves by keeping a boarding-house. Fifteen years ago she sustained an injury to the face when alighting from a stage in New York, and sued the company for \$10,000 damages. She claims to have received a judgment for \$30,000, which is, evidently, a delusion. She asserts that when brought to the Kings County Hospital, just prior to committal here, she had in her dress pocket newspaper clippings containing a full account of the litigation. Efforts were made to obtain these clippings, but we were informed by the hospital authorities that her clothing was consigned to the flames, in consequence of being infested with vermin. This is to be regretted, as the clippings, which we have every reason to

believe were there, would have furnished important information in connection with their present arguments and beliefs. She further asserts that she was defrauded out of the \$30,000 by the then district attorney who forged her signature and obtained the money from the bank. To escape prosecution, she states that he purchased a certain house in Brooklyn, valued at about \$10,000, and deeded it to her.

Her sister is a maiden lady aged 65, and came to Brooklyn from Scotland thirty-six years ago where she has resided continuously ever since. She tells precisely the same story regarding the litigation, defraudation and the owning of the house. In addition to these delusions, they both have auditory hallucinations, which were not manifested, however, for some time after admission. They say that certain physicians and others whom they have talked with have told them that the house is theirs and that they are to be liberated.

There is nothing in their case, beyond this irrational story, that would attract attention. They are women of meagre education, but are able to read and write. They retain their racial characteristics to a marked extent, notwithstanding their long residence in this country. There is a slight general mental enfeeblement in both, but not more in the case of the older one than we would *expect* to find in a person of her age under normal conditions. The memory in both is well preserved. Were they to *discontinue* talking of their delusions, mental disease would not be suspected. Their physical condition may be *said* to be fair. The older one is troubled more or less with chronic rheumatism and her sight is considerably *impaired*. She has complained of a numbness involving the *left* hand and a lack of strength in the fingers—a precursor, perhaps, of cerebral apoplexy. The younger one is rather emaciated and somewhat anæmic.

The fact that there seemed to be a sort of logical basis for most of their statements, combined with the remarkable coincidence of their being sisters, prompted us to make further inquiry into the circumstances. They gave as reference the name of the ex-district attorney (already alluded to), a prominent lawyer in Brooklyn, and, in reply to a communication from us, he stated that he knew nothing of the women except that for years they had made public offices and law offices in Brooklyn and New York

City their daily visiting places; that courtesy had compelled him to answer not less than one hundred letters concerning them, and that they desired to have indicted a certain judge and other distinguished persons who they claimed had cheated them out of a large sum of money.

The police authorities informed us that they rented the house which they imagine themselves to own, and were dispossessed for non-payment of rent. Then they burst open the doors and took possession again, which caused their arrest and arraignment for malicious mischief, and they were held to await the action of the grand jury. Subsequently their mental condition was looked into and insanity discovered.

Since admission they have kept together constantly, having little or nothing to do with any of the other patients. Whenever a medical officer is within sight they demand a hearing and persist in telling him that they are not lunatics and are being wrongfully detained. At these times the younger one frequently becomes excited and abusive, particularly when told that the house does not belong to them. The hospital physicians are now included in the conspiracy to cheat them out of their property, which they say is the reason they are not given their liberty.

It is probable that one of these sisters is the victim of "Communicated Insanity,"* but, in the absence of sufficient history, it is difficult to determine which, and, in both, hereditary predisposition would appear to be strongly suggested.

* See Tuke's Dictionary of Psychological Medicine.

ON THE USE OF Picro-FORMALINE IN CYTOLOGICAL TECHNIQUE.

(A PRELIMINARY COMMUNICATION).

BY ARNOLD GRAF, PH. D.,

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In applying cytology or the science of the cell to the elucidation of the problems of pathology, whether human or comparative, accurate and painstaking methods of preservation and staining are of primal importance. The whole technique of the modern cellular biologist is in decided contrast to the loose and comparatively careless methods subservient to the investigation of pathological histology, which, until recently, was concerned with the topographical study of communities and groups of cells, rather than with the study of the cell as an individual.

The technique of the cytologist, having for its object the demonstration of the wonderfully intricate internal organization of the cells, requires methods of the utmost delicacy, accompanied by accurate data of the manipulations at each stage of the fixation and preservation of the tissues. Some of the older methods used in the conventional modes of preservation for the study of pathology as, for example, Müller's fluid, while they may present a very perfect view of the topographical relation of groups of cells, destroy the finer internal structure of the individual cells and are utterly worthless for cyto-pathological studies.

On the other hand, even with the more refined methods of fixing tissues for cytological study, if these methods are not used with the experience, judgment and care which can only be obtained by studying cytology as a science, a number of intra-cellular artifacts may be produced which may be mistaken for pathological changes.

Finally, it is not sufficient to describe the action of the great mass of different fixing and preserving fluids as

being "good," "excellent," etc., for this or that tissue, but careful drawings should be submitted to show exactly what has occurred in every structure of the cell.

In order to accumulate more exact data of the action of cytological fixing reagents, during the summer of 1896 I began to investigate at the Marine Biological Laboratory at Wood's Holl, Mass., the influence which different fixing fluids exercise upon the finest cell structures with regard to their preservation and subsequent staining affinities.

This work will naturally take a long time for its completion, and I present the following notes in order to publish the formula of a new fixing fluid which I have found to be so excellent that it ought to be given over to investigators without delay.

In pursuing these investigations on the action of various cytological fixing media, I have commenced with invertebrate material, because here the cells are most favorable for investigation; they are larger than in the higher animals and the intra-cellular organization is much more distinct. The continuation of these studies in the higher vertebrates, especially man, can then be undertaken successfully, for the final object of the work is to determine the best and most practicable set of cytological fixing media for the human tissues, especially the nervous system.

In investigating the changes in the nervous system accompanying insanity from the standpoint of cytology, it is of fundamental importance that a work of this kind should be done with the utmost care and detail.

The leech has been selected to demonstrate the action of picro-formaline as a fixing reagent, for the histology of this animal has received much attention, and some of the cells are particularly well adapted for the study of cytoplasmic structures, especially the cytoplasmic reticulum.

Among the fluids which I had previously used were picric acid and formaline individually. I had long since found that picric acid was a very satisfactory fixing fluid

for leeches, with the exception, however, that the reagent interfered with the subsequent staining affinities of the tissues towards hæmatoxylin. The finest cell structures stain much less brilliantly after fixation with picric acid than after sublimate and other methods of fixation. Formaline, on the other hand, admitted of a splendid after-stain with hæmatoxylin, but was not satisfactory, as the finest cell structures were destroyed by the use of this preservation.

Dr. O. S. Strong, to whom I communicated these facts, suggested the combined use of both of these reagents as a means of combining the advantages of each for cell fixation and staining.

Before reporting the results obtained by the use of this new fixative, the reason why the structures appeared destroyed after the formaline fixation might be explained.

I distinguish two different kinds of fixing fluids. There is the one category of fluids which kills the cellular structures very rapidly without hardening them. To this category pertain most of the acids, *e. g.* picric, acetic, oxalic and nitric acid. Another class of fixing fluids both kills and hardens the cellular structures. This second group includes corrosive sublimate, perosmic acid, chrom-trioxide (chromic acid) formaline and alcohol.

The finer cellular structures, *e. g.* cytoplasmic threads, retain after the fixation with the first kind of fluids a certain plasticity or pliability, which is due to an incomplete congelation of the globulines and nucleo-albumines of which those structures are for the greater part composed. It is evident that the treatment with graded alcohols after the fixation, and the diosmosis occurring thereby will be less liable to injure these structures because they are by their pliability able to adapt themselves to the push and pull of osmosis.

If, on the other hand, with the fixatives of the second class the albuminoids are perfectly congealed, the structures become stiff, and if osmosis sets in during the immersion in alcohol, these structures are liable to be easily torn or distorted on account of their rigidity.

The fixing fluids of the first class, then, like picric acid, and the like, which act more mildly, are to be preferred.

The mixtures of picric acid and formaline which I have used are as follows:

- | | | | | | | | | | |
|-----|----|------|-------------|----------------|---|---|------|-----------|----------------|
| (1) | 1 | vol. | Picric acid | sat. in H_2O | + | 1 | vol. | Formaline | 5 per cent. |
| (2) | 1 | " | " | " | " | + | 1 | " | 10 " |
| (3) | 1 | " | " | " | " | + | 1 | " | 15 " |
| (4) | 95 | " | " | " | " | + | 5 | " | full strength. |
| (5) | 90 | " | " | " | " | + | 10 | " | " " |

It was, moreover, necessary to select such an animal for the experiment, the cytology of which was perfectly familiar to me, and which possesses as many different cell elements of large size as possible.

I have consequently selected *Clepsine nepheloidea nov. sp. Whitm.* a small species of leech which I had previously carefully studied.

These animals (procured from a pond in West Tisbury, Martha's Vineyard, Mass.) were totally immersed in the fixing fluid, while living, and remained in it for thirty minutes. Other specimens were immersed for two hours.

It might first be useful to mention that after a few violent contractions the animal stretched out perfectly, a fact that everyone who has had occasion to work with leeches will greatly appreciate.

After this period the animals were washed for one hour in a liberal supply of 30 per cent alcohol, then in 50 per cent alcohol; 70 per cent alcohol; 80 per cent alcohol; and finally preserved in 95 per cent and 100 per cent alcohol.

They were carefully imbedded in paraffine and sectioned with the Minot microtome. The thickness of the sections was $3\ \mu$.

For the staining of the sections I used Heidenhain Iron-Hæmatoxylin method with Bordeaux red as a contrast stain. They were mounted in Canada balsam.

The differentiation of the cellular structures was remarkably good, and I will now proceed to describe the aspect which these structures presented after the described treatment.

The cytoplasmic threadwork appeared extremely clear and well differentiated in all the cells. The threads were very distinct and of a light purple tinge. (Fig. 1, th.)

The microsomes stained darker and were plainly seen not to be enlargements of the cytoplasmic threads (as is the opinion of many authors) but to be separate bodies of a different substance. They are often attached to the threads, but many of them are entirely free. (Fig. 1, m.)

The vacuoles in the cytoplasm of the nephridial cells were very well preserved, and not shrunken at all. I have also been able, by this method, to detect certain structures in these cells, which to my knowledge have not been described hitherto, namely, peculiar accumulations of thread substance. These are small masses of homogeneous appearance of a light purple tinge possessing numerous processes which run out imperceptibly into the cytoplasmic threadwork. (Fig. 1, cm.) This discovery is of some interest as it shows us that the thread substance is not, as it were, merely an intervacuolar substance, but is a specific organized body which like the chromatin may be found in various structural stages; it may grow out from common centres in the shape of fine threads, and these threads may possibly be retracted. I do not hesitate to regard the thread substance and the microsomes as the living substance *par excellence* of the protoplasma.

This fact may be the more important, as it finds an analogue in the behavior of the so-called archoplasma,—that structure of the dividing cell which appears in the shape of an astral figure. In this case the centre of the figure is occupied by a light staining mass, the attraction-sphere, from which the cytoplasmic rays radiate toward the periphery of the cell. It is well known that during the different phases of karyokinesis these rays vary greatly in their length; they may sometimes even be totally retracted into the central sphere. This attraction-sphere likewise varies in size according to the stages of division of the cell.

As the nephridial cell possesses a number of highly in-

teresting structures it forms a splendid test object for the capability of the fixing fluid to differentiate these structures. I have described the organization of the nephridial cell at some length in my lecture on the physiology of excretion (Wood's Holl Biological Lectures, 1896) and will therefore merely mention this organization to the extent of making the matter clear.

The cell is pierced by a central canal, in the wall of which the cytoplasmic threads arrange themselves in a peculiar manner. This arrangement is, in short, the following: We find in the wall of the intra-cellular duct ring-fibres (r. m.), placed at regular intervals running all around the duct at right angles to its longitudinal axis. These fibres are studded with coarse microsomes, which are also regularly arranged and which project into the lumen of the canal. Between the ring-fibres we find connecting bridges of fine cytoplasmic threads, running parallel to the axis of the duct (Fig. 2, c.). The ring-fibres are very coarse, about six times as thick as the cytoplasmic fibres, and stain dark purple. The microsomes, which are about four times larger than the cytoplasmic microsomes, stain intensely blue. This whole exceedingly delicate structure appears very brilliantly stained after the use of the picro-formaline method. I need only mention that this apparatus is nothing but an intra-cellular musculature, producing by the contraction of its elements (ring-fibres) a peristalsis of the central duct, by which means the liquid contents of the duct are pushed out of the cell.

The *peripheral organs* of the nephridial cells which I discovered last summer are also very well differentiated by this method. (Fig. 3, p.).

It is with regard to the nuclear substances that this method gives the most valuable results.

We know that the chromatin granules and the nucleoli of these cells stain very intensely with hæmatoxylin, carmine and the basic aniline dyes, after the use of all the known fixing fluids, whereas the acid aniline dyes are cytoplasmic stains *par excellence*.

I have succeeded with this method in obtaining a differentiation between the chromatin and the substances which compose the nucleolus. The chromatin shows, after being fixed with picro-formaline, no affinity to hæmatoxylin, but it stains very intensely with the Bordeaux red. The nucleolus, on the other hand, stains very intensely with hæmatoxylin.

The nuclear membrane, which usually stains very deeply with hæmatoxylin, appears in the picro-formaline preparations bright red. (Fig. 4, m.).

I have not yet any definite results as to the staining of the linin threads and of the so-called oxy-chromatin granules.

In order to recapitulate I will give a list of the cell-structures with their specific stain:

Cytoplasmic threads (Fig. 1, th.),	-	-	-	Light purple.
Threads of the peripheral organs (Fig. 3, p.),	-	-	-	Bright red.
Ring threads of the intra-cellular duct (Fig. 2, r m.),	-	-	-	Dark purple.
Cytomicrosomes (Fig. 1, m.)	-	-	-	Dark (bluish).
Granules of the peripheral organs (Fig. 3, p.),	-	-	-	Dark blue.
Granules of the ring threads (Fig 2),	-	-	-	Dark blue.
Nuclear membrane (Fig. 4, m.),	-	-	-	Bright red.
Chromatin (Fig. 4, ch.)	-	-	-	Bright red.
Nucleolus (Fig. 4, nl.)	-	-	-	Dark blue.
Vacuole inside the nucleolus (Fig. 4, n. v.),	-	-	-	Dark red.

The importance of the reversion of the staining affinities of the nuclear structures may be shown in one example.

I discovered in the leeches a certain kind of cells, which I called reserve-food cells. These cells are more or less filled with little bright yellow globules which I regard as a reserve food substance provided for the period of rest during winter.

In sections it became apparent that the whole thread-substance of the cell was used up in the formation of these globules, at least as far as we can deduce from the fact that in cells with only a few nutritive globules (Fig. 5, f. g.), part of the cytoplasmic network is yet present.

Very important changes take place in the nuclei of

these cells. In the place of the nucleus I found in some of these cells only a few irregular, homogeneous masses of a bright red color. Around these red masses was a cluster of small black granules, and many of such granules were also scattered through the cell. (Fig. 5, nlg.).

It seems that the nucleolus broke into pieces which were dispersed through the cell, possibly to take their share in the formation of food globules.

This shows us that with this method we possess a sure means of tracing the fate of the nucleolus and of the chromatin separately. We all know what a mysterious body the nucleolus is, and how difficult it is to determine its rôle in the life of the cell. Here we have made a step which will help us to solve this problem.

This method will no doubt allow of different other applications, as for instance for the investigation of the granules in the leucocytes or in the ganglion cells.

It is certainly a very interesting chemical reaction especially because neither formaline nor picric acid alone gives it. It seems that the formaldehyd enters into a chemical combination with the picric acid, which compound possesses this peculiar affinity to the chromatin and the nucleolar substance.

So much for the cytological advantages of this fluid, but there is another great practical advantage in the use of the fluid, which is as follows: Apparently it makes no difference how long the tissues are immersed in this fluid. An embryo of *Squalus Acanthias* left in picro-formaline during two months and a few days was very well preserved, for neither shrinkage nor swelling was to be detected.

The advantage which is offered by this property for scientific expeditions is evident. It is very difficult to get material from expeditions, cytologically well preserved as the complicated manipulations connected with the preservation, with the washing, etc., are too troublesome, and most of the specimens are simply thrown into alcohol and left in it until they arrive in the laboratory, often months or years afterwards.

micro-formaline the treatment is very simple. Picric acid in crystals and concentrated formaline, always make up the micro-formaline with spring water and immerse the specimens in a liberal allowance of the fluid. The bottles are then well stoppered, and at the first opportunity expressed back to the laboratory with directions for further treatment. Even the very finest cell structures are not very well preserved by this method, but one may at least be sure to obtain histologically satisfactory specimens.

By this method a great quantity of alcohol is saved, the use of which, as is known, affords the greatest economy in tropical expeditions.

I would recommend for expeditions to use two formulas for formaline. Immerse the specimens for one day in the solution No. 1; and afterward immerse them directly in a solution made of 2 vol. picr. acid conc. and 1 vol. formaline 10 per cent or 15 per cent.

15th, 1897.

EXPLANATION OF THE PLATE.

FIGURE 1. Cross-section through a nephridial cell near the internal funnel of *Clepsine nepheloidea* n. sp. Whitm. Picro-formaline No. 1. Magn. hom. imm. Apochr. Zeiss 2mm. comp. oc. 4.

- th. Cytoplasmic threads.
- c.m. Accumulations of cytoplasmic thread substance.
- m. Microsomes.

FIGURE 2. Longitudinal section through a nephridial cell of *Cl. nepheloidea*, near the external opening. Magnification and preparation as in Fig. 1.

- c. Central canal within the cell.
- n. Nucleus.
- p.g. Peripheral granules.
- r.t. Ring threads of the central duct.
- r.m. Microsomes of the ring threads

FIGURE 3. Cross-section through nephridial cell of *Clepsine Hollensis* n. sp. Whitm. Magn. Apochr. Zeiss 2mm. comp. oc. 6.

- n. Nucleus.
- v.c. Vacuole canals.
- p. Peripheral organs.
- cy. Cytoplasm.

FIGURE 4. Nucleus of nephridial cell of *Cleps. nepheloidea*. Magn. as Fig. 3.

- nl. Nucleolus.
- n v. Vacuole inside of nucleolus.
- m. Membrane.
- ch. Chromatin granules.
- l. Linin threads.

FIGURE 5. Reserve food cell of *Cleps. nepheloidea*. Magn. as Fig. 1 and 2.

- ch. Chromatin.
- nlg. Nucleolar granules
- f.g. Food granules.
- cy. Remains of the cytoplasmic thread-work.

c xm

rt nl

FIG. 2.

FIG. 4.

FIG. 3.

nlx

fg

cy

FIG. 1.

FIG. 5.

Graf: Picro-Formaline in Cytological Technique.

Net type printing - Boston.

REPORT ON THE USE OF PELLOTINE AS A SEDATIVE AND HYPNOTIC.

BY RICHARD H. HUTCHINGS, M. D.,
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Pellotine is an alkaloid obtained from several varieties of cactus, common to the Mexican plateaus, known collectively as pellote. It is found in the market in the form of muriate of Pellotine, which is a white crystalline salt freely soluble in cold water, and possesses a bitter, gourdy taste which is not persistent or very disagreeable. The drug was introduced to the profession by Professor Jolly, as a hypnotic and sedative, and it was with a view of testing its usefulness in certain conditions common among the insane that it has been used in the wards of the St. Lawrence State Hospital. There are upwards of a hundred recorded instances of its use among eleven patients. The results have been, on the whole, rather favorable, though unpleasant side effects were noted in several instances, and in several cases it seemed to have no effect in moderate doses. Following is a brief summary of four illustrative cases:

CASE NO. 2612.—Agitated melancholia; a woman, age 39, who five years ago suffered from an attack of paralysis from which she recovered with impaired movement of the right eye. She had been under observation for one month and during that time was troubled with insomnia and extreme restlessness. When awake, she constantly rubbed her hands and moaned and when out of bed could rarely be persuaded to sit, but walked the floor in a rapid, nervous manner. She had received massage and warm baths for her insomnia and later had had trional, which gave her fairly comfortable sleep. She was given a half grain of pellotine hypodermatically at 9.00 A. M. on January 27th. At that time she was walking up and down the floor and could not stop long enough to answer questions addressed her. Within a few minutes she became more calm, exchanged her night-dress for a house dress and sat down. One hour later she had an attack of faintness, nearly fell to the floor, and was afterwards nauseated and vomited slightly. Her pulse, usually rapid, was not appreciably affected. At noon the nausea had passed off and she

was calmer and brighter than she had been before. She spent the afternoon reading or employing herself in several ways and talked quietly with others. The good effects continued through the night; she slept eight hours, which was better than she usually did with trional. On the following morning she was again agitated and the dose was repeated; on this occasion the patient was kept quieter and no ill effects were apparent, but she complained that she felt sick afterwards and wished it stopped. During this day she had alternate periods of restlessness and calm but slept seven hours that night. On January 29th one-fourth grain was given which produced little or no effect. On the 30th a half grain was given hypodermatically at 10.00 A. M. when she was agitated and restless, and in an hour she had become quite calm and sat in her chair reading. While still reading, she had an attack of syncope, during which she lost consciousness and her pulse was reduced from 100 to 70 per minute; the giddiness passed off quickly upon the patient assuming a recumbent posture and she was sufficiently well an hour later to eat dinner. She continued quiet during the day but toward evening began to grow restless again and that night slept five hours. After this the medicine was reduced to one-quarter grain morning and evening and was continued for three weeks with no bad effects. This amount seemed sufficient to keep her in a fairly comfortable condition; she slept from five to eight hours at night and, though agitated at times during the day, had periods of calm during which she read and amused herself in various ways. She had so far improved within three weeks that the pellotine was discontinued and nothing substituted for it.

CASE No. 2294.—A woman, aged 22, recovering from an attack of acute mania had been annoyed by another patient and became noisy and hysterical. She was found throwing small articles of furniture about in her room and scolding and she asked for medicine that would quiet her. She was given pellotine one-half grain by the mouth and requested to lie down, which she did. She fell asleep in an hour, and, though she was awakened at three o'clock by the nurse counting her pulse, she went to sleep again and slept until half past four, when she awoke refreshed and calm.

CASE No. 2574.—Aged 22, a case of acute mania, who had been quite noisy and talkative during the day and inclined to be wakeful and talkative during the night. She was placed upon pellotine one-quarter grain morning and evening, which was continued for four days, but discontinued as it seemed to increase her excitement and to diminish her hours of sleep.

CASE No. 2623.—Agitated melancholia; man, aged 50, under observation five weeks. He was extremely restless and wakeful; could not be kept in bed without constant struggle. Was given pellotine one-half grain hypodermatically at noon on February 9th, and remained

in bed until 3.20 o'clock, but did not sleep. On the 11th at 11 A. M., he received a second hypodermic and was quieter for four hours, but did not sleep and would not remain in bed. On the 12th at 11 A. M. the dose was repeated, but seemed to have no effect. This patient complained of vertigo and nausea and expressed it graphically by saying that his "head went around like a top."

An objectionable effect of the drug is its tendency to produce vertigo when given in doses sufficient to produce its full effects; this being observed in a number of instances when nothing else could be assigned as a cause. It was only observed when the patients were out of bed, and a recumbent posture may be found to obviate it to a great extent. In two instances in the same case the patient would have fallen, if not supported, and in one of them actual loss of consciousness supervened. The vertigo came on suddenly in from one-half hour to one hour after the hypodermic injection of one-half grain of Pellotine, and disappeared rapidly after the patient had the assumed recumbent posture. In no instances were the effects sufficiently severe to call for treatment, but the patients were alarmed by them and did not wish to continue the medicine.

The sleep produced by Pellotine was particularly calm and natural; the patient could be readily roused and would sleep again if the effects had not worn off. No unpleasant after effects, such as headache, nausea or coated tongue, were observed. The patient usually awoke refreshed and calm. When given during the morning hours, two or three hours' sleep could usually be obtained, after which the patients would be bright until bedtime when they usually slept well again. Not more than four hours' sleep could be obtained during the daytime, but when given at bedtime the patients, as a rule, slept longer, frequently through the entire night. Administered in this way its good effects were particularly observed in three patients, who were selected because of their noisy and restless condition. One half grain of Pellotine was given by mouth at bedtime to each and was followed by four and six hours sleep respectively in two of them, and

the third slept all night. Of the two who were awake for a time, one was quiet, the other talked but was not noisy, and remained in bed. On the following night all three slept well during the entire night, though medicine was not given.

Where sleep was not produced, in several instances, the drug had a calming effect which lasted throughout the day. This was well shown in case No. 2612. The pulse was not markedly affected, except in cases where pronounced giddiness and nausea were produced; in one such case being reduced from 100 to 70. In other instances, it was unchanged or was diminished from two to six beats per minute. The appetite was not diminished; on the contrary, it seems to have been improved in the one case where Pellotine was given daily for a considerable period. It is worthy of remark that in the three instances where vomiting occurred shortly after taking Pellotine, the patients recovered rapidly and ate fairly or well at the next meal.

It is not possible to determine accurately the value of a drug of this kind in one series of observations, but it seems at least to merit further trial. Several points regarding its physiological action have suggested themselves, which have not been determined to our satisfaction; its effect upon the appetite; its action, if any, upon the secretions. It did not seem to affect the secretions in any of the cases noted above and, if further trial proves this to be true of its action, it will greatly enhance, in our belief, the value of the remedy.*

* It is to be regretted that Pellotine can only be obtained in small quantities, and that, for a time at least, its great cost will prevent its general use.

IDLENESS IN INSANE ASYLUMS ON HOLIDAYS.

By E. H. WILLIAMS, M. D.,
Assistant Physician, Matteawan State Hospital.

There can be no doubt but that America is becoming Europeanized in regard to the increased number of holidays which she observes, but the subject of advantage and disadvantage of such observations is too far reaching for anything but an exhaustive discussion. With the majority of people in the outside world, however, such days have little effect in interfering with routine work and habits, because this majority has no great regularity in its habits, while the minority who are methodical do not allow such things as holidays to interfere with their daily routine. But in large institutions where *everything* is done methodically, the question of so many interruptions to the established régime sometimes become very serious.

In our insane asylums, for example, there is reason to believe that the custom of observing holidays is anything but beneficial to the general welfare of the inmates. After a patient has been an inmate of any of our State asylums for a few months his system becomes so accustomed to the regular hours for meals, and regularity in retiring at night, that he becomes more methodical than is conceivable to the average man outside. He needs no clock to tell him when such hours for meals and bedtime arrive, and he does not breakfast or dine at *about* such and such an hour, but *exactly* at such an hour (or minute, rather) day after day. Any little variation from this routine often completely upsets him, for this regularity in eating and sleeping is an all-important factor in the treatment of mental disorders in our asylums.

But while the patient's system is showing the good effect of such exacting routine, there comes here and there a holiday, with meals coming at irregular hours to break in upon the train of established habit. Breakfast is postponed an hour, and the poor delusional "dement" finds

that the tormenting calls of an empty stomach are unanswered. He has no mind to reason the why and the wherefore, and even if he could reason, his inhibitory powers are probably largely in abeyance; so that he answers the torments of his empty stomach by assaulting some attendant or fellow patient, breaking furniture, injuring himself, or doing whatever comes first into his distorted mental fancy. Everything being more or less contagious among the inmates of asylums, one disturbance tends to produce another; so that the veteran attendants of the asylums know what to expect on holiday mornings if breakfast is not forthcoming at the regular time, and are doubly alert on such occasions.

Nor is the late hour for breakfast the only evil feature of the holiday, for ~~breakfast~~ ^{the regular régime of work} ~~the regular régime of work~~ ^{is not} ~~is not~~ ^{and the men who are accustomed to} ~~and the men who are accustomed to~~ ^{work outside, and who spend little time upon the ward are} ~~work outside, and who spend little time upon the ward are~~ ^{now confined in the hall for the day.} ~~now confined in the hall for the day.~~ ^{Many of them, even} ~~Many of them, even~~ ^{of the very best workers, are mere machines mentally,} ~~of the very best workers, are mere machines mentally,~~ ^{who do their work simply as automaton.} ~~who do their work simply as automaton.~~ They have no minds to appreciate the significance of a holiday, but they have enough of cultivated automatism to know the difference between being confined on the wards instead of being employed at their accustomed tasks. The result is that their daily allowance of energy finds no chance to express itself in the usual way, so that it is often expended in another direction—usually in some form of violence.

The salvation of a distorted as well as a normal mind, is employment; and let no kind-hearted philanthropist imagine that he is doing a kindness to the "poor fellows" who form the simple-minded majority in our insane asylums by giving them days of rest, either irregularly or at stated intervals. The popular belief that the system of man requires a rest of one day for every certain number of working days can not be substantiated in fact. A casual glance at almost any system of routine work tends to refute it. The athlete knows that any interruption to his

daily exercise does not improve his condition, and the mental worker finds that the same rule applies almost equally well in his line of work.

If much benefit resulted from the observation of holidays in asylums, or if amusing and diverting sports could be substituted for the daily work, the case would be different. But while bodily energy persists among the chronic insane, versatility of mind is wanting; so that days of diversion are not appreciated by this class of insane patients. And while we may be making a happier nation by adding to our list of national holidays, we are certainly not enhancing our methods of treating insanity by allowing such days to interfere with the regular routine of asylum life.

SOME PHYSICAL STATES IN MELANCHOLIA.

BY SELDEN H. TALCOTT, M. D.,
Superintendent Middletown State Homeopathic Hospital.

The physical signs of mental disorder are apparent, more or less, in every form of insanity. The ravages of mania are often as noticeable as are the effects of a cyclone that has swept over a forest, and laid low its most stately monarchs of pine or oak. The disintegrating tendencies of dementia are revealed in the most positive evidences of decay throughout the human temple. So likewise in melancholia, we note certain physical conditions which may come, after further investigation, to be recognized as diagnostic. We have often noticed diminution or irregularity of respiration in patients suffering with melancholia. We have also noticed that heart troubles often prevail in such cases. Again, the circulation is frequently impaired in cases of mental depression; and the same may be said of digestion. The skin is often changed in cases of melancholia; and the bodily weight is frequently decreased, especially in the early stages of the disease. The bowels

are sometimes regular, and at other times sluggish or disordered through inattention.

In order to show the relationship which exists between the mental state known as melancholia, and certain physical states which seem to accompany this disease, I requested my interne, Dr. Arthur P. Powelson, to make a record of these physical states in one hundred cases of melancholia in men, and one hundred cases of melancholia in women; and in order to present to the readers of the BULLETIN the various physical derangements which most commonly occur in cases of melancholia, we subjoin the following list of tabulated statements:

MEN.		WOMEN.	
<i>Respiration.</i>		<i>Respiration.</i>	
Normal breathing.....	20 per ct.	Normal breathing.....	14 per ct.
Rapid and shallow,.....	8 "	Rapid and shallow.....	14 "
Shallow.....	10 "	Shallow.....	10 "
Subnormal.....	28 "	Subnormal.....	30 "
Subnormal and shallow, 20	"	Subnormal and shallow, 22	"
Irregular.....	14 "	Irregular.....	10 "

NOTES.—*Rapid and shallow* refer to respirations which exceed 22 per minute, being thoracic in character.

Shallow denotes those which are thoracic from 16 to 20 per minute.

Subnormal refers to those cases where there are less than 16 respirations per minute.

Subnormal and shallow. Less than 16 respirations per minute, and thoracic in character.

Irregular. Not rhythmical in character.

<i>Heart.</i>		<i>Heart.</i>	
Normal... ..	16 per ct.	Normal.....	6 per ct.
Hypertrophy.....	8 "	Hypertrophy.....	6 "
Irritable.....	36 "	Irritable.....	52 "
Weak.....	28 "	Weak.....	28 "
Valvular lesion.....	12 "	Valvular lesion.....	2 "
		Resistive and could not examine.....	6 "

NOTE.—An irritable heart is a common accompaniment of sub-normal breathing.

<i>Circulation.</i>		<i>Circulation.</i>	
Good.....	38 per ct.	Good	42 per ct.
Poor.....	62 "	Poor.....	58 "

MEN.		WOMEN.	
<i>Digestion.</i>		<i>Digestion.</i>	
Normal.....	46 per ct.	Normal.....	52 per ct.
Acute indigestion.....	14 "	Acute indigestion.....	22 "
Chronic indigestion.....	40 "	Chronic indigestion.....	26 "
<i>Bowels.</i>		<i>Bowels.</i>	
Regular.....	60 per ct.	Regular.....	58 per ct.
Irregular.....	6 "	Irregular.....	10 "
Chronic constipation....	26 "	Chronic constipation....	32 "
Chronic diarrhoea.....	8 "	Chronic diarrhoea.....	—
<i>Skin.</i>		<i>Skin.</i>	
Normal.....	38 per ct.	Normal.....	46 per ct.
Dry.....	32 "	Dry.....	16 "
Moist.....	24 "	Moist.....	20 "
Clammy.....	6 "	Clammy.....	18 "
<i>Weight.</i>		<i>Weight.</i>	
Increased.....	54 per ct.	Increased.....	48 per ct.
Decreased.....	38 "	Decreased..	40 "
Average.....	8 "	Average.....	2 "
		Not weighed.....	10 "

NOTE.—The foregoing cases were examined and their conditions noted during the last six months of the year 1896. The weights were taken July 1st, 1896, and again January 1st, 1897, and the estimated increase or decrease made accordingly.

It is a matter of clinical observation that many patients suffering with melancholia do not breathe as they should; neither do they eat as they ought to eat; and again, they fail to exercise properly, or to take sanitary care of the various leading organs and functions of the body. Hence, it seems clear to me that a proper course to pursue in the treatment of melancholia is to enforce a substantial and suitable diet; to encourage a renewed and appropriate use of the lungs by careful and systematic respirations; to maintain with imperative zest the cleanliness of the skin and its included organisms; and to restore by every possible means the normal functions of the *viæ vitales*. Observations should lead us to a discovery of the actual condition of affairs in each case of melancholia, and an enthusiastic purpose should inspire us to the prompt correction of all physical abnormalities of those who may come under our care.

SPEECH DISTURBANCES IN EPILEPTICS.

BY CHARLES W. PILGRIM, M. D.,
Medical Superintendent, Hudson River State Hospital.

Probably the most characteristic speech disturbance occurring in epilepsy, especially when it is associated with insanity, is that which Echeverria has designated as the echo-sign. Echolalia and verbigeration also occur under similar conditions although they are not such common symptoms and are not at all characteristic of epilepsy. During the past few months I have had our epileptic patients carefully observed, with special reference to speech disturbances, and have found among the number several cases presenting in a typical manner the phenomena above mentioned.

The echo-sign, which consists of the repetition of some word or words two or three times in succession, either in the middle or at the end of a sentence, is well illustrated in the following case, for a detailed report of which see the *American Journal of Insanity* for April, 1884. The patient was a man of dissolute habits in whom the seizures did not appear until about the age of thirty-three. He had been under observation more or less, during attacks of mental disturbance, for about eight years and it is positively known that the echo-sign did not appear until after the seizures began. The seizures always began in the morning and were invariably preceded by a night of wakefulness accompanied by incessant talking and almost constant repetition of words. A fair idea of the constancy of the "echo" may be gained from the following specimen of his conversation. In reply to the morning greeting he would invariably say: "Good morning, doctor, doctor, doctor! Good morning, doctor!" Frequently after leaving the dining-room he would exclaim: "I ain't had anything to eat in six months. You may not believe it, but it's God's truth, truth." Often he would soliloquize in the following strain: "You want to

keep, keep me alive as long as you can, as long as you can. I've been here seven years and I'll have to come here to the asylum if I live fifty years, fifty years, one year after another. It don't cost me a cent, cent * * * * What's the use of being born, born? Man's got to die, die, die. You can't take anything with you, and what's the use of being born, born, born, I say? * * * * I'm better and I'm glad of it. Thank God! God! God!" The patient died in *status epilepticus* about a year after this symptom became manifest. An autopsy could not be obtained on account of objections made by friends.

Another case which is almost as typical, is that of a woman forty-two years of age now a patient in the Hudson River State Hospital, who is in a condition of dementia due to epilepsy which has existed since childhood. The following is an exact reproduction of my conversation with her, when I examined her for the purpose of incorporating a description of her case in this paper: "How do you do, Miss Smith?" "How do I do? I do! I do! I feel very nervous, nervous." "Where did you come from?" "I came from, I came from New Paltz, when I came here, here, here." "How long have you been here?" "I've been here six weeks, six weeks, weeks." Her attacks are nocturnal, occurring generally two or three times a month, and the nurse informed me voluntarily that she had learned to expect the convulsions whenever the patient had an unusually talkative day accompanied by frequent repetition of words. As we were talking the nurse remarked that the symptom was unusually prominent that day. It immediately occurred to me that an opportunity was at hand to verify or disprove the statement that the echo-sign and the convulsions were concomitant, and, without letting the nurse know what I intended to do, I instructed the night attendant to watch the patient carefully and report to me the next morning as to whether or not any convulsions had occurred during the night. With much interest I read the report the next day and found that the nurse's predictions

had been fulfilled, for the patient had had a severe convulsion during the night although she had been free from them for more than two weeks before. After an attack this patient always seems brighter and repeats very little until the time for another attack draws near.

This symptom is frequently manifested in writing, when the patient is not too demented to use pen and paper, even when it is not noticeable in speech. To illustrate this point, I quote from two letters which have been recently written by epileptic patients. The first is from a woman who mistakes the identity of the physicians, imagining that one of them is a person whom she calls Frank. In the letter she says: "I could do any chore for, for, for Frank, but I'll never live with John again. I'd quicker, quicker knock him down."

The second letter is from a patient who urges her husband to purchase a farm near the hospital and contains the following sentences: "If you would sell, sell your farm for \$5,000 and come here and buy a small place, you will say it is a business place. It would look natural to you, you. If you can come, come as soon as you can, can, can."

The next case is more strictly one of echolalia, as the repetition of words spoken in the presence of the patient, with a close attempt at imitation of the tones, are prominent features of the symptom. This patient is an imbecile boy, nineteen years of age, in whom epilepsy appeared at the age of five. He has, on an average, from two to three seizures a week, which are mostly nocturnal. He is always disturbed and violent after his seizures. He frequently repeats words just heard, and if the attendant, who is a German, with a strong accent, says, for instance: "Shaughnessy, sit down," or "Murphy, please be quiet," the boy will almost always repeat his exact words and fairly well imitate his tones and accent. In answer to the salutation, "How do you do? Are you pretty well to-day?" he will invariably reply: "How do I do? How do I do, do? Pretty well to-day! Pretty well to-day!" As will be seen, while the above sentences contain the "echo"

partake of the characteristics of echolalia to even a degree. That, in fact, is the symptom which we expect in such a case, for it is conceded by all that echolalia is quite frequently an accompaniment of imbecility.

Next two cases which may properly be described paper illustrate quite well the occurrence of verbalization both as a pre- and post-convulsive symptom.

First case is a girl, nineteen years of age, who became epileptic convulsions at the age of three. They are usually nocturnal and two or three occur every second or third night. The morning after an attack she is stupid and disturbed and repeats, for hours at a time, in a sing-song way, some senseless sentence. Sometimes it is "Lies, couldn't she tell the truth; lies, couldn't she tell the truth?" Again it may be, "Devilish old man, devilish old fool you," or "Where's my letter? Where's my letter?" But whatever sentence she may repeat, she keeps repeating that one only until the next attack, when she will probably choose another.

Second case is a man fifty years of age, who is in a state of terminal dementia as the result of epilepsy which began in early childhood. His seizures occur about once a week and are usually nearly equally divided between nocturnal and diurnal attacks. Always immediately before the convulsive stage begins he repeats over and over again the sentence, "Oh, Lord have mercy on us, Lord have mercy on us!" This he keeps up in a monotone (pathetic verbigeration) for some time, which ceases when the convulsive seizures are fully developed. In this case the pre-convulsive character of the symptom, which is very marked, bears out Neisser's statement that this particular form of verbigeration always accompanies the stuporous state.

Several other cases presented symptoms similar to those described, but I have purposely confined my attention to those in which the speech disturbances are characteristic and uncomplicated. Whether these

symptoms occur with equal frequency in sane epileptics I am unable to say, as my observations refer only to epileptics who are insane.

Another symptom connected with speech which seems to me to be of importance from a diagnostic point, although I have never seen it mentioned, is the half whine or drawl which is so often noticed in epileptics. Like the speech of the general paretic it is difficult to describe, but the experienced ear easily detects it and it is often possible to make a diagnosis of epilepsy from this symptom alone. So common is this symptom, especially in women, that in one ward with thirty-two patients, no fewer than fifteen manifest it in varying degrees.

Stammering and hesitancy of speech due to delayed mentalization are quite frequent symptoms, while the difficulty of utterance which occurs when epileptics become excited is noticeable and distinctive.

The etiology of speech disturbances is a moot question. Romberg considered the echo-sign an evidence of cerebral softening while Echeverria makes the rather indefinite statement that it is "mainly the result of a perverted will." When speech disturbances are connected with epilepsy it seems to me that they can best be accounted for by Neisser's theory of the etiology of ver-bigeration. It is his belief that there exists in the speech centres a state of inhibition which is broken through by some unusual stimulus such as may arise during various epileptic states. Forced or mimetic speech is the result, and when the inhibition is marked new ideas fail to replace the old ones, the patient is unable to rid himself of the original words or sounds, and the various speech disturbances here recorded are developed.

While the preceding brief histories throw no light upon the pathology of epilepsy and make no advances in its therapy, they are given as comparatively typical examples of instructive symptoms in what is probably one of the most interesting diseases which the physician is called upon to treat.

MORAL TREATMENT OF EPILEPSY.

BY WILLIAM P. SPRATLING, M. D.

ther disease to which human flesh is heir, will ration and continuous enforcement of the factors titute moral treatment produce such valuable and ng results, as in epilepsy; and under no other colony system in the care and treatment of this s of defectives, can the factors that make in the e its moral treatment be attained.

ie word moral in this connection in its broadest cope of application, and would have it include d principles that underlie the science of right conduct and character.

r to bring out fully the necessity for, and the value of, the means embraced in the moral treat- his disease, it will be necessary to make some ry comments on its character and the manner in affects the individual.

we are ignorant of the material conditions that phenomena imply. That damaging changes, y or prolonged, varying in severity, take place in highly specialized tissues of the economy with rence of every seizure is a fact beyond dispute. nges vary in every possible degree, from simple disarrangement that gives rise to perverted l action for a brief period of time only, to fixed g pathological changes that produce permanent ction. We have ample clinical evidence that ements are true.

pilepsy is a disease, so-called (including in the of the term congenital or acquired defective the higher nervous centres of remote or im- rigin, likewise admits of no dispute. Clinical in abundance can be adduced to sustain this lain proposition.

ental infirmities of epileptics as manifested in

irritability of temper, irrational conduct, inconstancy, tendency to the commission of acts of violence, and general disregard for the laws of health, order and society, to say nothing of the graver states of mental disorder to which the disease predisposes them, point clearly and unmistakably to disease of the brain. They may suffer seizures at very rare intervals only, and when they do occur they may be so mild in character as to escape the notice of all but the skilled observer; nevertheless, the internal disruption incident upon such a seizure may be immeasurably greater and more destructive than its external manifestations would seem to indicate, or that would attend a seizure having more marked objective symptoms.

Every epileptic is at times an irresponsible agent; upon his field of consciousness and mental integrity there is a blot. It may be small and of the most transitory duration, and so dim in outline as to appear as the faintest shadow, but it is there; it has a vital hold upon his life, and dominates in varying degrees his habits and acts.

In studying epilepsy we see and study symptoms only. Of the minute and intricate mechanism involved in the production of epileptic phenomena we have, as yet, no knowledge. We are steadily acquiring greater knowledge of brain centres; we are studying more closely the aura, or warning, that so often appears to indicate the coming seizure; we are paying more attention to auto-toxis, in all its forms; to irritants of all kinds, intrinsic and extrinsic, the action of which possibly serve to disturb the equilibrium of the nervous system; but we have not as yet constructed or discovered an acceptable basis on which to found a logical theory as to the cause or causes of epileptic phenomena.

The explosive theory, *per se*, as far as it goes is all very well and plausible, but its fatal fault lies in the fact that it deals with the manner in which the fit is produced and not with the causes that underlie the conditions that make the manner.

There must of necessity be a sudden liberation of nerve force to produce so general and violent a display of muscular action as that occurring during an epileptic seizure. The same thing, the liberation of force, holds true when we chop wood, run a race, turn the crank of a grindstone, or exert continuous physical or even mental energy along any restricted line. A short, sharp, quick run rapidly exhausts the stored up energy, central and peripheral, that feeds the power of locomotion, and produces physiological fatigue that it would take miles of ordinary walking to produce. In either case there is a discharge of nervous force, the only difference being that in one it is rapid and quickly produces exhaustion, while in the other it takes place more slowly and exhaustion is longer delayed. Through constant use certain cells of the higher nervous system are exhausted. They are made to constantly, and with more or less rapidity, discharge stored up energy. The resultant action of a given faculty, or member, or group of muscles, is governed solely by the degree of the rapidity of discharge of the nerve centres that control such faculty, or member, or group of muscles.

In some types of epilepsy the liberation of energy comes all at once; in others it dribbles away, so to speak, and the tension in the epileptogenic centre is not relieved or exhausted under a much longer period of time.

Muscular activity and the ensuing fatigue are correlated much more closely with fatigue in the central nervous cells than we commonly believe.

If epilepsy has, or is based upon, a single essential condition, my conception of it is, that it *consists in a periodic liberation of dissipated energy, that tends to perform no pre-conceived physiological act*. This is purposely verbose to explain fully the meaning of my conception. In the concrete, two words will suffice to express it—*dissipated energy*. All other conditions or symptoms that follow this, not excepting the chief attendant one of disturbed consciousness, are of secondary importance.

But why is there a dissipation of energy? In what

manner and through what causes does it arise? Herein lies the problem and here begins the real study of the etiology of epilepsy, and in doing this we must study a host of factors and conditions as varied and as complex as the pre- and post-natal life conditions of the individual.

But it is not needful to my purpose in the elucidation of the title of this paper, to pursue this line of study any further in this connection. I have covered the ground essential to the demonstration of two objects—one, the former, I believe, unassailable; the other, the latter, by no means immune from the shafts of scientific criticism. The former refers to the rational moral treatment of epilepsy as based upon the mental condition of the epileptic, and all that such a condition implies. The latter refers to the early and essential involvement of the fundamental elements of the motor activities of the individual suffering from the disease.

In taking up the former, the object first to be attained in the moral treatment of the epileptic, is to place him under such environment that renders it most difficult for him to gratify the unhealthy cravings of morbid and capricious tastes and desires. It is not possible to make his environment such that he will be absolutely debarred from indulgences that are not good for him; without, at the same time, robbing him of that broad and consistent amount of freedom, and active outdoor life and exercise that has such paramount value for him. It is practically impossible to throw such environments around the epileptic in his own home. Sentiments, stronger and more active than good judgment on the part of the parent for the child, invariably creep in to defeat the very objects we are trying to attain.

In his home, the epileptic is humored and pampered; permitted to eat whatever he chooses; obey or disobey regulations for his welfare, as his fancy dictates; is praised for his minor virtues, however feebly exposed, and pitied for his largely controllable shortcomings, and in time becomes, through the natural and unrestricted promptings

of his disease, an irritable, fault-finding, intractable and ungovernable child.

Household sympathy creates the worst form of mistaken policy on the part of the parent for the welfare of the child.

I do not include all epileptics in this category, but that it is the condition of the great majority of them, any person who has had much experience with them will testify.

But back of the improper and faulty moulding of his habits and character during his early home life, he bears a graver handicap bestowed upon him as a heritage. Congenital deficiencies, in his physical and mental constitution, find in him a fruitful field for expression, or by virtue of having pursued him through some generations, they have made him so. The more deeply he is touched by these influences, the less of a free and responsible moral agent he is and the greater the need for continuous supervision over him.

One hundred and thirty-one of the first one hundred and forty-five patients admitted to the Colony presented evidences of imperfect or perverted development, and, according to Gowers, 35 and 37 per cent respectively male and female epileptics acquire the disease through heredity. We must, therefore, regard most epileptics as faulty in moral stamina, due to congenital or acquired unhealthy conditions of the central nervous system. And just in proportion to the degree of entangling alliances originally dependent upon, and existing between his physical, mental, and moral stamina, and that of his immediate ancestors, will our efforts to better his condition meet with success.

Another, and one of the strongest links in the chain of evidence of proof that epilepsy is largely a condition ingrained in the life of the individual, is that it has for so many centuries obstinately resisted all therapeutic measures applied for its relief.

It is safe to say that under the ordinary treatment of the disease as practiced by physicians at large, not more than

two per cent. of cures are effected; while under the colony system from six to ten per cent are cured.

The colony system embraces the features *par excellence* for the moral treatment of the epileptic. Here he is obliged to enter upon a systematic and routine life, with enough diversion and freedom of movement and recreation to promote physical development, and for the pursuit and acquirement of such mental accomplishments as he is capable of receiving. He must take his meals at a regular hour; he can not have food that is not good for him, for the reason that such food is not prepared; he must eat in a manner that conduces to good digestion and not constantly gormandize, as is his wont; he is made to employ his energies in the prosecution of some given task, varying his work from time to time as his condition may seem to require.

It is my belief, and I can cite half a score of cases in support of such belief, that certain epileptics expend through the medium of legitimate labor, surplus energy that otherwise might have been expended in a convulsion. The exercise of muscle means the exercise, growth and development of brain cells that control such muscles. Not only can surplus energy be gotten rid of in this way, but in the end the cells of the brain acquire a greater degree of resistance to abnormal stimuli and irritants.

And just here I wish to qualify by adding to the opinion previously expressed that if epilepsy had an essential condition, it consisted in a manifestation of dissipated energy. Prior to such manifestation of motor disturbance there must have been a sensory stimulus, and it is well to bear in mind the manifold ways in which such stimulus can be applied. It may proceed from any part of the body, through the medium of sensory nerves, or through the more highly organized nerves of the special senses.

"A sensation which gave rise to no motor element was never experienced. This element may be small in comparison with some sensations, but it exists." *

* Halleck: Education of the Central Nervous System.

The truth that sensation tends to pass into motion shows us that the foundation for motor development lies in sensory training. The principles of sensory and motor training, as exemplified in the Sloyd system of education, are based upon the recognition of this fact.

So closely are the elements of motor and sensory life interwoven that influences that affect one very generally affect the other, and the strengthening and development of one means the same thing for the other.

Exercise causes more blood laden with nutritive elements to flow to the cells. Likewise the debris, which under such conditions is more rapidly produced, is more rapidly carried away. The exercise of muscle and brain for the epileptic is of especial value. Nearly all of his kind suffer from a lack of coördination of the finer muscle movements, and his sensory apparatus is notoriously liable to suffer mal-adjustment.

The colony system provides means for the accomplishment of all these things. Through diversified industries, systematically and faithfully prosecuted, he can acquire a good appetite, a good digestion, a good muscular system, a better brain, a broader scope of mental horizon, and through the regulated and properly adjusted agencies of school life, a fair degree of technical knowledge that he can apply when the exercise of mental power is called for.

But even here these things are not easy of accomplishment and only by the application of the principles involved when falling rain-drops wear a stone away can they be realized.

In purposely omitting to make mention of any manner of the drug treatment of epilepsy in this paper means nothing save a consistent regard for the purpose for which it was written, namely, to deal solely with the factors of its moral treatment, which I have done in the concrete, since extended elaboration of the subject in the space at my disposal was not possible.

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THE LEGAL RESPONSIBILITY IN EPILEPSY.

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While it is generally conceded that a recognized case of epilepsy is not at all times responsible for his acts, it must be remembered that in isolated and somewhat rare forms of the disease the question of irresponsibility is not so easily determined. Many persons who pass in everyday life as queer or eccentric are generally considered harmless and perhaps sane so long as their acts do not make them prominent or bring them to the serious notice of the officer of law and order; likewise many an epileptic, whose disease is of long standing, may possibly have been looked upon as a safe member of the community, and yet the moment he commits an act productive of serious consequences there immediately arises the question of his responsibility. In the consideration of such cases so far as their acts make them amenable to the law, we have to consider them as dual beings, viz.: as normal men when not mentally affected by their disease and as insane when suffering from its consequences; and, furthermore, as the act for which they are responsible is performed in the former or latter state, so are we to condemn them as criminals or acquit them as lunatics.

For the past four months we have had under observation twenty epileptics with a special view to determine their responsibility and to test their memory of acts performed during the appearance of the psychical manifestations of the disease.

As the histories of the whole number would take up an unnecessarily large amount of space, we publish only five abstracts, believing that these will sufficiently illustrate the statements and conclusions which follow them:

CASE I.—Age when admitted 44; born in United States; is by occupation a barkeeper; has always been temperate in his habits; no hereditary history. His wife states that the patient has had convulsions, always at night, for the past ten years, but had never been

excited after them until the present attack. He had not had a convulsion for a year until ten days before admission, when he had one mild in character, followed by such violent excitement that he had to be tied to his bed. During this period of excitement he made an attack upon his son and threatened to kill him. On admission to this hospital he was quiet and orderly, and gave a detailed account of his maniacal attack. He remained quiet for five months, only complaining of an occasional headache, at the end of which time he became noisy and excited and remained so for three days, when he again became quiet. There were no convulsions, so far as known, preceding this attack. About a month after this he had "several" convulsions, followed by some excitement lasting for a few days. He then became quiet, remained so for ten months, and was discharged.

Re-admitted six months later, having been arrested in Central Park where he was found preaching to a crowd, and proclaiming himself to be the Messiah. From the time of his admission six years ago until the present, he has had an attack of excitement once in about every six weeks, when he always exclaims repeatedly in a loud voice and theatrical manner: "I am the resurrection and the life. I am the Messiah," etc. If questioned at this time, he says that he realizes that he is insane, that he is more excited to-day than yesterday, or, if the attack is passing off, that he is feeling better and will soon be quiet. He had four convulsions during the summer of 1895, one of which was followed by an attack of excitement identical with those not preceded by convulsions. He states that in the fall of 1889 he had his first attack of excitement; that he was lying in bed when suddenly there appeared to him a vision, in which he saw Pontius pilate washing his hands and he himself bearing the cross. He then got up and proclaimed himself to be the Christ and said: "I am the resurrection and the life," etc. His wife tried to make him go back to bed and to remain quiet, but he could not do so, as he was impelled to proclaim these things and he did not have the power or desire to desist. He does not know what the power is, but he does know that he can not resist it.

Referring to his second commitment he says that he was in the lower part of the city when he was "impelled" to go to the park, and as he felt that he was the Creator he had to proclaim himself the "resurrection and the life," etc. During the attacks he says that he feels much elated and very happy. He always has headache and nausea preceding the periods of excitement and realizes that an attack is approaching.

CASE II.—Age 17 years; born in the United States; single; temperate; occupation has been that of a student. There is a history of heredity, both his maternal aunt and grandfather having been insane. His mother attributes his trouble to a fall which he had

when a child, in which he severely injured his head. He did not have an epileptic attack until two years ago, since which time he has had an occasional convulsion, dropping to the floor very suddenly, but very seldom had any convulsive movements of the muscles. She first noticed that he was somewhat depressed, and was very absent-minded. He thought an officer was after him, and asked her to hide him, saying the "Cop" was coming. He was a particularly bright boy and was often left at home by his mother when she was down town. During these psychical manifestations, which were apparently not preceded by a convulsion, he would steal anything he could lay his hands upon, and had taken a large quantity of silver, together with some furs, portieres, etc., which were stored away in the house. All these things he pawned, but never made any use of the money, except to throw it away among his companions, and to burn it, saying that "he had money to burn." This was not discovered until he began to carry the furniture from the rooms, when his mother, suspecting him, followed him, and recovered a portion of what he had pawned. He would take off his coat, vest and shoes, and pawn them, afterwards tearing up the pawn tickets and money, and scattering the pieces among his friends. He was found waiting for his brother in the hall intending to kill him with a large knife, which he had in his hand. Afterwards he remembered nothing about it and could give no reason for waiting to kill his brother.

On admission to the hospital he was well behaved but seemed not to have a proper amount of interest in what was passing around him. He complained of having terrible pains in the head at times, and said he was told that he did things of which he had no recollection whatever. He said he did not know why he did these things as he had everything that he wished. He answered questions in an intelligent manner. Three months after admission he was found in bed one night with a sheet tightly wound about his head and neck. He was revived but had no knowledge of what he had done and said he must have wrapped the sheet about his head in order to stop his headache. He did nothing unusual for five months from this time, until one day without any warning he broke a pane of glass with his hand and attempted to cut himself with the pieces. He only succeeded in inflicting a superficial wound on his wrist. He persisted in his attempts to injure himself for some time but afterwards had no recollection of having done anything unusual, and when shown the cuts and pressed for a reason as to why he did it, he said he must have had a spell.

CASE III.—Age 36 years; born in Germany; is by occupation a cabinet-maker; no history of heredity obtainable; had always been temperate in his habits. He had been married nine years and had always been devoted to his family.

On the night of his first attack he was cheerful on his return from work, greeted his wife pleasantly, kissed his children and played with the baby. After he had been home about one-half hour he went down stairs for ten minutes, returning greatly changed in appearance, his face being flushed, and his eyes having a staring look. He walked up and down the room and did not reply to the questions of his wife. Suddenly he stopped and seizing one of the children threw it through the window. He secured another one after a chase through another room, and also flung it out of the window. Fortunately the children struck the railing of the fire-escape, and did not fall to the ground. His wife escaped from the room with the baby, the husband attempting to follow her, and several of the neighbors who endeavored to prevent his doing so were knocked down on the stairs and, while jumping upon one of these men while prostrate, he was struck a blow from behind, and before he could recover from the effect he was bound with a rope. On admission to Bellevue he was very much excited and difficult of control. He refused to answer questions or give any information regarding himself.

On admission to this hospital he was quiet and well behaved, and answered questions readily. Said he thought his wife was unfaithful to him, and that she wasted his money. His first attack at this hospital occurred six months after admission, and was one of petit mal. After an extended conversation with the ward physician, he suddenly stooped down from a standing position and began passing his hand over his perinæum outside of his clothes, as if searching for something. The patients near him spoke to him, but he did not seem to hear them. After feeling about for three or four minutes he ceased, gave a long sigh and sat down on a chair. He then seemed conscious that he was being watched, walked over to another seat and took up a newspaper. He could give no explanation of his queer behavior, and seemed confused when questioned about it. On the second night following he became excited in his room, and, on opening the door, he was found walking about excitedly. On seeing the attendant, with a howl he attacked him, striking at, and attempting to scratch him. It was found necessary to call four other attendants to control him. Two of the attendants' hands were bitten quite severely, and they received numerous bruises and scratches.

He has had a number of other attacks, in all of which he became quite violent. These are usually preceded by a slight attack of petit mal. During the intervals between attacks he is very quiet and industrious, and talks in a rational and intelligent way.

CASE IV.—Age 20 years; born in Canada; by occupation a plumber; single; habits, temperate.

His paternal grand-uncle was insane, following an injury received by being struck by a falling tree.

His mother for three months preceding her death suffered from melancholia. She had an almost irresistible impulse to kill her child. This condition continued until her death from tuberculosis pulmonalis. Her half uncle on the maternal side was feeble-minded, but it is not known that he suffered from epilepsy.

The cause of his epilepsy was given by his father as being due to masturbation. The first convulsion, occurring in May, was followed by another in June, both of these being mild in character. In May of the next year he had, as described by his father, a typical attack of grand mal lasting about five minutes. This was followed by a period of great excitement during which he attempted to escape, impelled apparently by fear of his father. This condition existed for forty-five minutes. In his next attack it is not known that he had any convulsion. He came down stairs about 5 A. M. with a shirt wrapped about him. He filled a basin with water as if intending to wash, did not do so, but walked out of the house, through the yard, climbed over a fence and was awakened by walking in the cold water of a marsh through which he was attempting to pass. After this his room was locked, and when the next attack occurred, about one month later, he was unable to find the key, which had been hidden, or to open the door. He then broke up all the furniture in the room and demolished the mirror, evidently in a state of fear and excitement. He then jumped through a window which was on the second floor to the ground below, and was found in a nude condition wandering about the street. His next attack occurred some months later, and so far as known was not preceded by a convulsion. He dressed himself and walked down stairs, was followed by his father, and asked several questions, all of which he answered in a rational way. He left the house before he could be prevented by his father, and was found by an officer some time later, gazing from a parapet of a bridge at the water below. Awakening he returned to his home. His next attack occurred also at night, and so far as known was not preceded by a convulsion. He dressed himself, left the house, closing all the doors after him and walked to the depot. Not finding any train in at the time, he started for Mount Vernon on foot, a distance of some miles, walking upon the railroad track. During his walk there he was compelled to get out of the way of two express trains. On his way he stopped and conversed with a track hand, and upon arriving at Mount Vernon, he answered a number of questions addressed to him by the station agent in a rational way. He was awakened by a Mount Vernon policeman, and had no knowledge whatever as to how he had got there or what his reason had been for going. After this, feeling that he might do some injury to himself or others, he voluntarily came to the Manhattan State Hospital for treatment. When admitted he was very much worried in regard to his condition and was extremely apprehensive. He

says that he has no knowledge as to what is going on about him during his walks, and upon awakening, he is unable to tell anything that has occurred. After admission he was constantly watched, but nothing occurred, except an attack of grand mal one night about three months after he had been here, after which he exhibited not the least tendency to somnambulism. He is bright and appreciative, and talks in an intelligent way, perfectly realizing his condition.

CASE V.—Age 46 years, born in England; stone-cutter; married; intemperate in his habits; no history of heredity.

Patient has had infrequent and mild attacks of epilepsy for a number of years, and has been committed to an insane asylum on two previous occasions. His wife states that he had never been excited up to the time of his first commitment and had been in the habit of sleeping for a day after a convulsion, when he would awake clear in mind. On this occasion he did not sleep as long as usual; upon awakening he made an attack upon his wife and had to be restrained. Since this, he has, during these attacks, threatened to kill his wife, and upon one occasion obtained possession of a large knife with which he attempted to murder his whole family, but was prevented from doing so with considerable difficulty. On admission to the Manhattan State Hospital, he was quiet and conversed intelligently but admitted having hallucinations of sight, particularly at the time of his convulsive attacks. He remained a quiet and orderly patient for about four months after admission, when he suddenly became very much disturbed, rushed to the end of the ward, demanding that he be released at once or he would force his way out of the building, and, upon being told he could not go out, attempted to break the windows. Upon being prevented from carrying out his designs he made an attack upon the ward physician, who was present at the time, and became very threatening and abusive in his language, saying that the physician was the cause of his detention in the hospital, and that he would kill him upon the first opportunity. He was restrained with considerable difficulty and the next morning had a confused idea of what had happened, was very profuse in his apologies, but was unable to give a reason for his strange behavior, except to say that he knew what he was doing at the time but was wholly unable to control himself. He has had similar attacks at intervals of some months, and at such times wanders about in a dazed state. His appearance is much changed, his face being markedly flushed and his eyes having a strange look. He uses the most filthy and abusive language, and will assault anyone within reach. During the two years of his residence in the hospital he has not had an attack of grand mal, and these attacks are probably the psychical equivalent of the convulsion. The patient states that he remembers all that happens during these seizures and undoubtedly does have a fair knowledge of occurrences,

at the same time realizing that he should control himself at such times, but says he can not do so. He has no delusions or hallucinations, and is generally quiet, neat and orderly, spending most of his time in reading.

It will be noted from the foregoing abstracts of histories, and we have noted the same in a number of other cases, that while some have complete amnesia of all events happening during the epileptic seizure and are unable on recovering to give an account of anything that they have done during this period, it now and then appears that certain cases do not believe and can not be convinced that that they have departed in any way from the normal state. Other cases not so frequently met with, not only have a distinct recollection of suffering from the epileptic seizure or its equivalent, but they can give a graphic and minute account of everything that takes place, before, during or after the attack excepting, of course, the period of the actual convulsion. They seem to have a knowledge of right from wrong, and realize at the time of committing the act that they are doing wrong, but state that they are unable to restrain themselves. At the beginning of an attack they frequently see visions and suffer hallucinations of hearing and become thoroughly controlled by them and obey them. These persons having attacks at infrequent intervals, may at such periods have an irresistible desire to commit a criminal act, and may immediately afterwards become apparently sane. If the history of the accused is not known there may be no reason apparent for the commitment of a crime, and a mistake in judgment could readily be made were we to base our opinion only on the present condition of such a person.

Cases I and V illustrate well this latter form of epilepsy, both having at infrequent and irregular intervals periods when they become dangerous to those around them, Case V being very abusive and aggressive, constantly watching for an opportunity to injure either his physician or some of his nurses. His attacks are apparently not preceded by convulsions nor has he been known to have a convulsive

attack since his admission to this hospital, but it is probable that he is subject to, and his excitement may be preceded by, petit mal, but this has not as yet been determined. At the time of his commitment he admitted "seeing visions" and said that "voices talked to him," but later on denied all hallucinations. His periods of excitement are of short duration after which he becomes quiet and is very profuse in his apologies for his behavior. He has a perfect memory of all his actions and conversations, but says that for some reason he acts under impulse and is unable to restrain himself.

In Case I the periods of excitement are known to be but rarely preceded by either petit or grand mal, but there seems to be simply a gradually increasing excitement, during the height of which he is usually tractable and can be made to enter into conversation, but as soon as left alone he again becomes noisy and restless. After the attacks, when questioned about his acts he gives a detailed account of what he has done and laughs at the absurdity of his conduct. Though he has not been particularly dangerous toward his nurses and fellow patients while under the restraining influence of hospital care, it is extremely probable that were these influences removed and the opportunity presented he would prove a dangerous member of society. Both of the above cases when not disturbed are apparently perfectly sane and there would be considerable difficulty experienced among the general public in arriving at a satisfactory explanation of their behavior during the disturbed periods, and in case of their committing a criminal act there would be, without a history of morbid psychical phenomena, a question as to the outcome of a legal procedure. A lack of this knowledge by the jury and legal profession has caused the justice of many verdicts to be questioned.

Cases II, III and IV illustrate the form of epilepsy in which there is a psychical phenomenon with total loss of memory of events during the time of the attacks. This form is more common than that in which a memory of

events is retained. These latter cases do not present so much difficulty in the courts, as would the two above cited, for they are more easily recognized as cases of epilepsy and their statements are more readily believed than the statements of those who can give a good account of their actions and who even say that they know they have done wrong but, knowing this, are still powerless to control their impulses. By the physician, cases such as the above are understood and given their true weight, but it is not yet generally known that some of the apparently milder forms of epilepsy are fraught with the most danger, and this point has not been as easily grasped by the legal mind as some other of the few facts in medicine which lawyers have as yet absorbed.

Case IV presents the interesting and somewhat rare complication of Somnambulism or an "Ambulatory form of Automatism," occurring in an undoubted epileptic, supplementing and sometimes replacing the ordinary epileptic seizure. This case, in common with the history of similar cases, presents an exceedingly neurotic family history, which we were not able to obtain in complete form. It is highly probable that there is a masked form of epilepsy underlying all cases of somnambulism, as epilepsy involves the same psycho-motor area of the brain and presents many symptoms resembling the automatic acts of the somnambulist. Hammond is of the opinion that "those persons in whom two distinct conditions of consciousness are known to exist, are affected by epilepsy and that under treatment proper for this disease the dual existence would cease." Charcot mentions a case, similar to the one cited here, in a man who although not himself apparently subject to epilepsy gave a family history of epilepsy for a number of preceding generations, one of his children also being subject to convulsions. It would appear as if in this case the ordinary epileptic seizures were replaced by a period of double consciousness in one of which he walked fourteen miles before regaining his normal state, and on another occasion went into a restaurant and or-

dered a dinner but did not partake of it. Later he purchased a railroad ticket, boarded and afterwards threw himself from a train, while crossing a bridge, into the river Seine, and was awakened by falling into the water.

The responsibility of somnambulists for crimes which they might commit would present many legal complications, as such cases are exceedingly rare and the law makes no special provision for them. They present a number of conditions so easily simulated and at the same time so little understood that it might be used as a plea in criminal cases, and where such a plea is put forth, justice as well as the public safety demands the most minute examination of the history of the accused.

In all epileptics the predominant characteristic during the disturbed periods is their irritability. This is the same whether they have or have not total amnesia of occurring events. In all of them the moral qualities are perverted, and the sense of propriety, decency and duty lost. They often present a double personality, which results in their leading, as it were, a dual existence, being virtuous one day and vicious the next. They may be at most times polite, obsequious and obliging, but there comes a time when they are not masters of themselves and there is an overflow of morbid energy. During the psychical disturbances there is a tendency to sudden and irresistible impulses usually of a destructive or homicidal nature, frequently being of the most violent and dangerous character without there being any apparent reason or motive, but when a case is presented as that of Maria Barberi, where, even admitting the presence of epilepsy, reason and motive were clearly shown and the act premeditated, there immediately arises a doubt in the mind of one familiar with such cases, whether she was mentally irresponsible at the time of the commission of the crime, or whether the crime was due to the vicious tendencies of the race to which she belongs, a people who habitually endeavor to redress their wrongs regardless of their own amenability to the law, being apparently satisfied that they

have employed the best means by which justice could obtain.

The question arises whether all epileptics who have violated the laws of the community are to be considered irresponsible for their acts, and are they to be acquitted because it is unquestionably established that they are subject to epileptic seizures. The law regards every one the same and excuses no one. An epileptic is not excused solely because he suffers from epileptic seizures, but is held as strictly accountable as a person suffering from any other disease. It is required that each establish to the satisfaction of the jury that the crime of which he is accused was not the act of a sane man. There may have been criminal premeditation and interested motive, and at the time he could have refrained from the commitment of the crime had there been any desire on his part to do so. Thus it will be seen there is no little difficulty in distinguishing the responsible from the irresponsible epileptic, and a door may be opened through which a person cunning enough to feign the symptoms of epilepsy or to declare that he was irresponsible at the time and had no memory of events which had taken place might be acquitted and escape a just punishment.

From the frequency with which epilepsy and mental unsoundness is put forward in the courts to-day, as a plea in cases of homicide, and from the present manner in which expert testimony is given, it has come to be regarded with suspicion and ridicule both by the general public and the courts. There are no cases which require nicer discrimination and more minute investigation than to decide on the moral and criminal responsibility of epileptics, inasmuch as actions closely resembling those of psychical epilepsy may arise as a result of the vicious tendencies of the individual, so that the diagnosis involves considerable difficulty. The question of the responsibility as regards a criminal act must be regarded as a medico-legal one, the law defining the ethico-legal position while medicine endeavors to fix the psycho-ethical responsibility of the indi-

vidual. The law presumes everyone to be sane and legally responsible for their acts, and, where there is a plea of insanity or irresponsibility put forward as a defense, requires them to prove it, not necessarily beyond a doubt, but by a preponderance of the evidence and to the satisfaction of the jury. In these cases the evidence of the physician and the records of medical experience should always receive the consideration due them.

In concluding this article on the legal responsibility of the epileptic, we have pointed out some of the difficulties which arise, rather than to offer any suggestions by which they might be remedied. As yet the legal profession and the physician are at considerable variance as regards the moral and mental responsibility of such cases. This, however, should not be, and the object of both should be to seek for the truth which must be established before justice can prevail and the public safety be preserved.

THE BLOOD IN EPILEPSY.

BY HELENE KUHLMANN, M. D.,
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In looking up the literature relating to the study of the blood in epilepsy, I found among the books and journals at my command but few references to it. Dr. Smyth, in the *London Medical Recorder*, reports a number of examinations which showed an average diminution in the number of red cells, and a diminution in the percentage of hæmoglobin in this disease. Following I submit a series of examinations in sixteen female epileptics, which were made within the past few weeks and may be of some interest:

Case.	Hæmo- globin.	Red Corpuscles per Cubic Millimetre.	Leucocytes per Cubic Millimetre.	Proportion.
1	.61	3195000	5000	1:640
2	.85	4375000	10000	1:440
3	.76	4115000	9000	1:445
4	.75	4560000	8000	1:570
5	.72	3285000	4500	1:765
6	.76	3025000	6000	1:500
7	.80	4755000	11000	1:430
8	.80	4710000	11500	1:410
9	.78	4360000	7000	1:625
10	.77	3830000	4000	1:960
11	.83	5540000	14000	1:400
12	.80	5860000	10500	1:560
13	.71	4970000	10000	1:500
14	.87	4687500	7000	1:670
15	.77	5437500	5500	1:1000
16	.63	4685000	10000	1:470

As will be seen from the above table, there was some diminution in the amount of hæmoglobin, the average being 76 per cent, and a very slight average diminution in the number of red cells.

The number of leucocytes ranged between 4,000 and 14,000, none of the cases falling far below or reaching far above the physiological limit. The proportion, too, between red and white cells approximated the normal in most of the cases.

The microscopical preparations showed no abnormal elements, but the proportion between the polymorphous leucocytes and the lymphocytes was changed in the majority of cases, the lymphocytes being present in relatively larger number than is found in normal blood, the small lymphoid elements being especially prominent. The eosinophiles were present in normal proportion.

The red cells showed no abnormality further than slight poikilocytosis, with the exception of Case 9, in which there was marked irregularity in the size of the cells. All took the stain well.

Although no definite conclusions can be drawn from so small a number of cases examined, yet it would appear

that there is in the epileptic an increased destruction of polymorphous leucocytes, with an increased production of lymphocytes. Whether this is true in all cases, whether it is distinctive of the disease or what its significance, will have to be determined by future examinations.

ELEPHANTIASIS ARABUM ASSOCIATED WITH INSANITY.

BY THOMAS E. BAMFORD, M. D.,
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Elephantiasis is only occasionally met with in this country; in the Indies, in Norway and in the Mediterranean, it is, however, common. The disease lasts a variable time, possibly a lifetime, as is the case in the subject of this report.

When fully developed there are three features which may be studied, namely, hypertrophic growth of cellular tissue, alteration in the appearance of the skin, and more or less deformity. These changes are brought about as the result of intermitting and repeated attacks of local inflammation.

Elephantiasis arabum of the leg develops, as a rule, in a chronic manner, with inflammatory symptoms renewed occasionally, paroxysmally, or at irregular intervals and these at first represent the only morbid phenomena.

The disease attacks males oftener than females. Seventy-five per cent of the cases reported were males. Of 945 cases reported, 729 occurred in people whose ages ranged between twenty-six and sixty years. The date of its first appearance was as follows: In sixteen cases it had existed since childhood; it occurred before the fifth year in seven cases; between the ages of six and ten in 33 cases; between the eleventh and the fifteenth year in 111 cases; between the sixteenth and the twenty-second year in 222 cases. As to the part affected, it was the

right leg alone in 307 cases, the leg with other parts in 287, or 30 per cent, both limbs in 344 cases, or 36 per cent, in other parts alone in seven cases, in the upper extremity in four cases.

The prognosis of the disease when fully developed is unfavorable. As regards the treatment, Dr. Carnochan believed it to be associated with an enlargement of the arterial trunks of the part, and upon this theory based his practice of tying the main artery of the limb and thus starving the disease. He was the first surgeon to perform this operation (in January, 1851) and the success he met with induced Dr. Bryant to follow his example in 1865. The subject operated upon was much benefited and the case was reported in the *Med. Chir. Trans.*, 1866. Amputation has been tried, but, in most cases where the leg was involved, the results were not encouraging. Moncorva and Silva Araujo claimed brilliant results from the electrolytic action of the constant current, but Kaposi states that the above method has failed in his hands.

The case here reported is one of unusual interest because of its association with insanity covering a period of several years:

Mrs. C., age 65 years; widow; seven children; occupation, housewife; nativity, Ireland; has been in the United States thirty-seven years. Father died of epithelioma; mother died of phthisis pulmonalis. Patient's habits had always been good. She is said to have had inflammatory rheumatism for several years. At the age of seven the patient is said to have received a fall sustaining an injury to her left leg above the ankle. Three months later there were signs of ulceration of the leg below the knee which was followed, in the course of a few weeks, by necrosis of the tibia. Several spiculæ of bone were removed and in a short time the wound healed. The patient remained in a comfortable condition for more than two years when she began to experience severe pain of a neuralgic character in the affected limb. In the course of a few weeks erythematous patches developed, which gradually extended and finally involved the whole leg below the knee. The limb became swollen and the tissues infiltrated. Vesicles formed, followed by a discharge of lymphatic fluid. These symptoms were accompanied by gastric irritation and a slight febrile movement. In a short time the acute symptoms subsided. The swelling was reduced and the patient appeared in her

Bamford: Elephantiasis Arabum, associated with Insanity.

usual health, save that the part attacked was slightly larger than before. She had a relapse within three months, at which time the symptoms were more pronounced. The enlargement of the limb was very great, with distension and rupture of the lymphatic spaces, together with a discharge of a milky or serous fluid. The limb has now reached an enormous size, the calf of the leg measuring nearly twenty-six inches, with a fold at the ankle nearly one inch in depth. The swollen limb presents nodular masses grouped at different parts, separated from one another by deep sulci which are especially marked at the flexure of the ankle joint, as is shown in the accompanying illustration. The secretions have a very offensive odor. So great is the discharge of lymph that whenever the patient is led about the ward the impression of her foot is seen after each step, caused by the accumulation of the fluid on the sole of the foot. The affected limb appears shortened and the skin is discolored. There is considerable hyperæsthesia at the knee-joint, but below this point there is almost complete anæsthesia. There are also evidences of degeneration of the muscles of the lower extremity. The power of flexion and extension of the foot is lost. The right leg is now slightly œdematous and somewhat larger than normal.

Urinalysis: Quantity, normal; reaction, acid; sp. gr., 1020; no abnormal ingredients.

Examination of the blood: Hæmoglobin, sixty per cent; hæmocytes, 2,650,000; leucocytes, 14,000; no peculiarities with the exception of the diminished number of red globules and the prominent appearance microscopically of the white corpuscles.

The patient has been insane for several years. The first symptoms noticed by her friends were those common to melancholia. She had hallucinations of hearing and delusions of persecution, which suddenly developed after a severe attack of inflammation of the affected part. She was depressed, confused and mildly disturbed. The insanity steadily progressed and at the present time she is demented, restless, and her memory is much impaired. The capillary circulation is markedly imperfect and anæmia is a prominent symptom. It is said that the patient has never suffered from erysipelas, malaria or any other affection with which elephantiasis is usually associated.

The disease has been known to appear as the result of an injury and it would seem as if traumatism was the etiological factor in this case.

CASE OF ANEURISM, AND RUPTURE OF ASCENDING AORTA.

By J. E. COURTNEY, M. D.,
First Assistant Physician, Hudson River State Hospital.

The chief interest of the following case consists in the obscurity of the symptoms of aneurism and the manner and suddenness of death.

Anna K.—Widow, 60, admitted April, 1895; weight, 163 lbs., 5 feet, 4 inches tall; pulse, 80; blowing murmur of heart; tongue coated, skin puffy and pale; case of mania, sub-acute; assigned cause, intemperance and irregular life.

Patient described hallucinations of sight and of hearing, for example, that colored lights were flashed upon her at night by electric lanterns, and that vile epithets were applied to her, all of which had gone on for four years, but worse for the last year.

Her face was pitted from small-pox occurring at age of two years, hands heavy and puffy, fingers stubby and tremulous, skin thick, waxy and muddy, and many of the phenomena presented were those of myxoedema. Soon after admission she began to work and employed herself regularly in the industrial department, not complaining of cough or sickness.

There was a little hoarseness and a few times she complained a little of mild asthmatic attacks at night, some shortness of breath on exertion, and of nasal catarrh. Mentally she was mildly hilarious, talked a great deal about some man who wanted to marry her, and clung to the delusions described above.

On January 31, 1897, she worked as usual and that night was quiet and appeared to sleep well. A little after five the next morning the night nurse noticed her in the act of getting up and preparing to dress, her attention was next attracted by hearing her fall on the floor, and she found her with blood pouring from the mouth and nostrils; she died in ten minutes. The autopsy showed the ascending

A

b

c

c

FIG. 1.

- a. Openings in aorta protected only by plugs of fibrin
- b. The rupture.
- c. Calcareous scales

FIG. 2.

- a. Esophagus, opened.
- b. Trachea.
- c. The rupture.

Courtney: Case of Aneurism, and Rupture of Ascending Aorta.

aorta and arch uniformly distended to three or four times the normal size, very thin, and covered inside with calcareous deposits. The rupture was into the trachea, just above the bifurcation. At several places the aorta was practically worn through, the thin parts being filled only by plugs of fibrin.

The point of the rupture had evidently formed gradually, the margins were rounded and well defined and had apparently for some time been held by only a plug of partially organized fibrin.

The stomach was full of blood swallowed either during slow hemorrhage while asleep or after she became unconscious. It is strange that she had no history of expectoration of blood, as oozing must have taken place before the final rupture. The ducts of the gall bladder were completely obstructed by a gall stone as large as, and about the shape of, the end of the thumb, and weighing nearly three drams. The gall bladder contained no gall but only limpid mucus. The illustrations are photographs of the inner and outer aspect of the diseased sections of the aorta.

REPORT OF ONE HUNDRED AUTOPSIES.

BY W. GRANT COOPER, M. D.,
Junior Physician, St. Lawrence State Hospital.

Autopsies are ever a source of deep interest to the progressive physician and especially to the alienist. They are valuable in that they confirm or disprove the diagnosis made previous to death. Then, in mental disease, we often have symptoms without discoverable brain lesions and conversely very extensive brain lesions are found post mortem, which were not suspected during the life of the patient. It is only by increased knowledge of the structure and function of brain cells, and the changes which take place in them when diseased, that we can hope

to explain these paradoxical phenomena or to treat mental disease with the best possible measure of success.

It is also of interest to note the frequency of occurrence of other visceral lesions in conjunction with brain disease. Whether there is an interdependence between insanity and certain physical lesions outside of the brain, or whether the frequent occurrence of the latter among the insane shows only their greater susceptibility, is a question to be determined by long continued observation.

There have now been held at the St. Lawrence State Hospital more than two hundred autopsies. The first hundred were reported by Dr. Thomas Conant Sawyer in the Eighth Annual Report of the hospital. The following is a continuation of the work begun by Dr. Sawyer.

In the appended report the percentages are given at the end, but owing to the variety of mental troubles enumerated, the number of cases in each class is so small that the value of the percentages is somewhat lessened when considered alone, but, added to other like reports, they will materially help in arriving at definite conclusions.

No report on heredity is made as so many of the cases were transfers from County Houses and other public institutions and accompanied with such imperfect histories that if a report were made it would not give a true idea of the existing conditions.

GENERAL PARALYSIS—NINETEEN CASES.

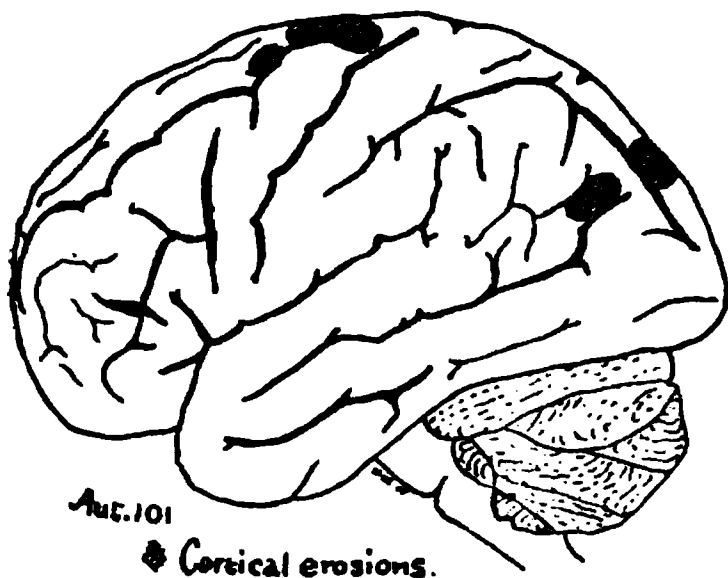
AUTOPSY No. 101, CASE No. 1801.*—Male, aged 40 (?), single, laborer; nativity, Ireland; duration of insanity, (present attack) two weeks. Complication, acute nephritis. Cause of death, general paralysis.

AUTOPSY twelve hours after death. *Head*—Skull cap thick, and on its removal a large quantity of bloody serum escaped. Dura was adherent to the skull and to the pia along the great longitudinal sinus and in the area of the Pacchionian bodies which were greatly enlarged. All the vessels of the brain and pia were distended with blood, and streaks of whitish opacity followed the course of the

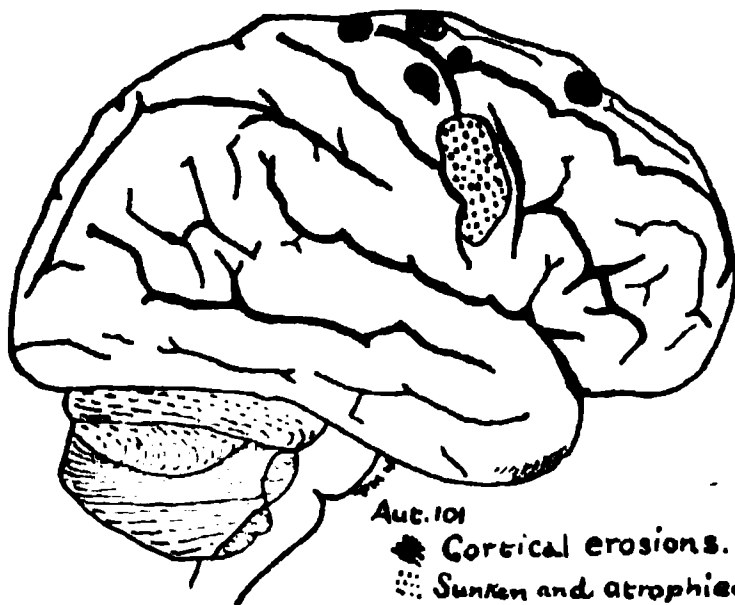
* This case was reported as a case of acute general paralysis, in the Eighth Annual Report of the St. Lawrence State Hospital, p. 157, by Dr. Robert G. Cook, to which reference is made.

larger vessels in the pia. There were adhesions between the pia and cortex so that erosions were left when the membrane was stripped.

They were especially marked along the longitudinal sinus and at the upper extremities of the ascending convolutions on both sides. The upper half of the right ascending parietal convolution, extending to the interparietal sulcus, for a space of one and one-half square inches, was flattened and sunken. The outer margins



of optic thalami were symmetrically softened on both sides and the degeneration was also marked in the genu of the corpus callosum. The ganglia were of good consistence, but were permeated with enlarged and distended vessels. The vessels of the ventricles were also distended, especially on the right side. The brain, as a whole, was well formed, the sulci were deep and the convolutions were well developed.



Chest Organs—Normal.

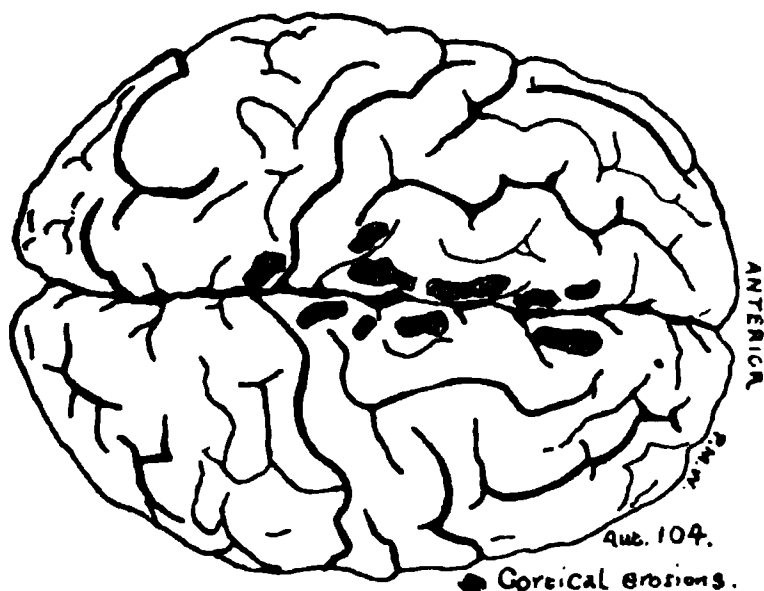
Kidneys—Showed signs of acute nephritis; capsules somewhat adherent in both; the cortices thickened and the markings fairly distinct.

AUTOPSY No. 104, CASE No. 1567.*—Male, aged 56, married, sailor; nativity, United States; alleged cause, cerebral apoplexy; duration of insanity, two years. Complication, cerebral tumor. Cause of death, general paralysis. Contributing cause, cerebral tumor.

AUTOPSY. Head—Skull was of normal thickness and density. Dura thickened and adherent to skull and on basal surface of brain to pia. Pia was adherent to cortex and under surface of temporo-sphenoidal lobe. A tumor one and one-half inches in diameter and of irregular contour, was found attached to the posterior aspect of the

* This case was also reported as a case of intra-cranial tumor, complicating general paralysis, in the Eighth Annual Report of the St. Lawrence State Hospital, p. 149, by Dr. Robert G. Cook.

petrous portion of the left temporal bone. This tumor extended from the basilar artery, which it displaced to the right, outward more than an inch. It had displaced the medulla to the right and caused atrophy and softening of the pons. The left lobe of the cerebellum was pushed upward and backward, and the peduncles were softened and attenuated. The tumor was firm, well supplied with blood vessels and free from central attachment.



Brain—Weight 48 oz. There were slight erosions of cortex, otherwise normal, except its shape which was distorted by the new growths.

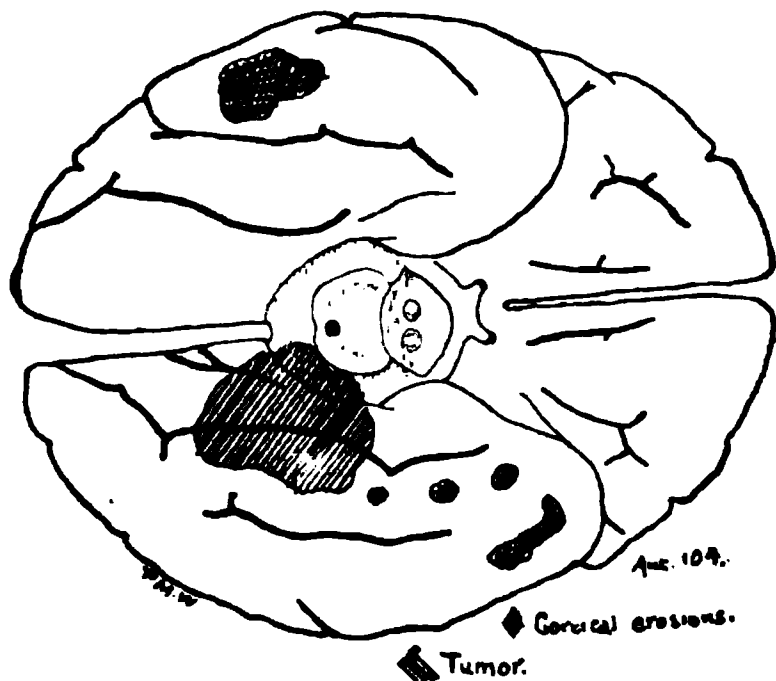
Lungs—On right side the pleura was thickened and many firm adhesions existed. The upper lobe of left side was adherent to parietes.

Heart—Weight 12 oz. Tricuspid valve slightly thickened with calcareous deposits at its base.

Liver—Weight $58\frac{3}{4}$ oz., capsule somewhat adherent, otherwise normal.

Kidneys—Weight of left $4\frac{1}{4}$ oz., of right 4 oz. In both the capsules were adherent, the cortices thin and each contained several small cysts.

Spleen—Weight $3\frac{3}{4}$ oz. It presented no gross pathological change.



AUTOPSY No. 117, CASE No. 1046.—Male, aged 43, married, brakeman; nativity, United States; duration of insanity, three years. Complication, uræmia Cause of death, general paralysis complicated by uræmia.

AUTOPSY. *Head*—Skull cap thick and of average density. Upon incising the membranes a considerable quantity of serum escaped. Dura was not adherent, but in anterior fossa of left side was stained a rusty color. On stripping the pia it was found to be very adherent to the anterior lobes which, again, were bound firmly together in the anterior segment of the longitudinal fissure; also the frontal and temporo-sphenoidal lobes at base of Sylvian fissure were separated with difficulty, causing erosions.

Brain—Weight 48 oz., of fair proportions and normal appearance. Vessels, walls thickened.

Lungs—Normal.

Heart—Weight 15 oz. Aortic valves incompetent, one cusp was calcified and bound down by adhesions. A considerable calcareous deposit was seen in the aorta just above the valves; other degenerative changes had also taken place in the artery wall so that in some places the entire wall was nearly eroded.

Liver—Weight, 81 oz. Extremely large but normal in appearance save a slight degree of congestion.

Kidneys—Weight of left $8\frac{1}{2}$ oz., of right $7\frac{1}{2}$ oz. Large, congested.

Bladder—Enormously dilated, extending to umbilicus, with coats much thickened.

Spleen—Weight 9 oz. Large and soft but presenting no gross lesions.

AUTOPSY No. 124, CASE No. 472.—Male, aged 36, married, manager of opera house; nativity, United States; duration of insanity, three years. Complications, lobar pneumonia and chronic nephritis. Cause of death, general paralysis and lobar pneumonia.

AUTOPSY. *Head*—Skull of unusual thickness and density in entire circumference. Dura was thickened and adherent to skull in places, also to pia-arachnoid. Pia-arachnoid much thickened and there was a large quantity of gelatinous substance taken from between their layers. There was a number of adhesions between pia and cortex which caused erosions on stripping the membrane. These adhesions were most numerous over the frontal convolutions of both hemispheres. The blood vessels of pia were increased in number but there were no marked changes in their walls.

Brain—Weight, $43\frac{1}{4}$ oz., convolutions markedly atrophied, sulci wide and gaping. Gray and white matter considerably softened but no further gross changes in interior of brain or at base.

Lungs—Lower lobe of left was completely consolidated, being in stage of red hepatization. Over this lobe there was an exudate of fibrin but no adhesions had formed. The lower portion of upper lobe was consolidated for about one and one-half inches, upper portion congested. Right lung, free from adhesions, normal in appearance except for old cicatrices at apex.

Heart—Weight 8 oz., small, walls thin, both ventricles contained organized blood clots, valves normal. Several thickened patches in aorta just above valves.

Liver—Weight 47 oz., soft and friable.

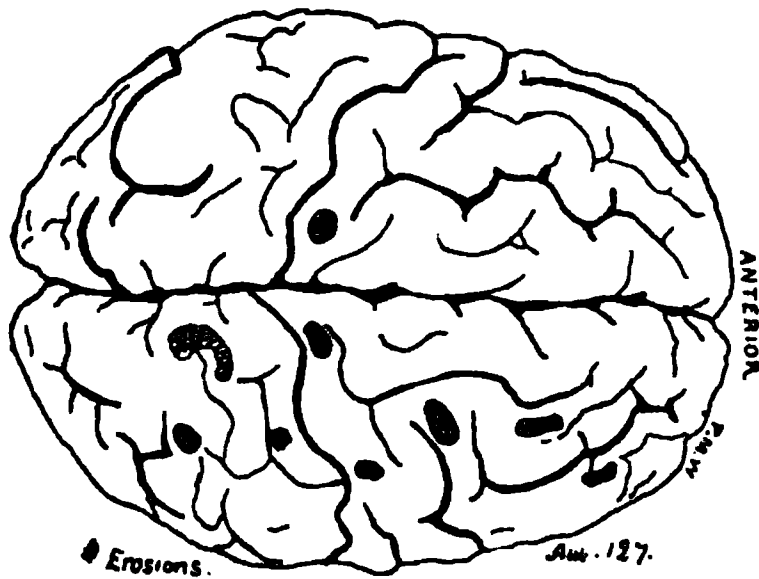
Spleen—Weight $4\frac{1}{4}$ oz., apparently normal.

Kidneys—Weight of left 6 oz., of right 5 oz.; in both the capsules were somewhat adherent, but the cortices seemed of normal thickness and the markings fairly distinct.

AUTOPSY No. 127, CASE No. 1803.—Male, aged 28, single, carpenter; nativity, Ireland; duration of insanity, five months. Complication, syphilis. Cause of death, general paralysis.

Symptoms.—Admitted September, 1894. Had hemianæsthesia of left side. Chief symptom, loss of memory; did not know his age,

where he came from or that he was sick. Disposition pleasant if not crossed. Vision $\frac{2}{80}$, slight congestion of disk, pupils normal, reaction to light good. Suffers much from headache. November, 1894—Is very irritable, memory not improved. On the 20th inst. he had eighteen general convulsions, became cyanotic and partly uncon-

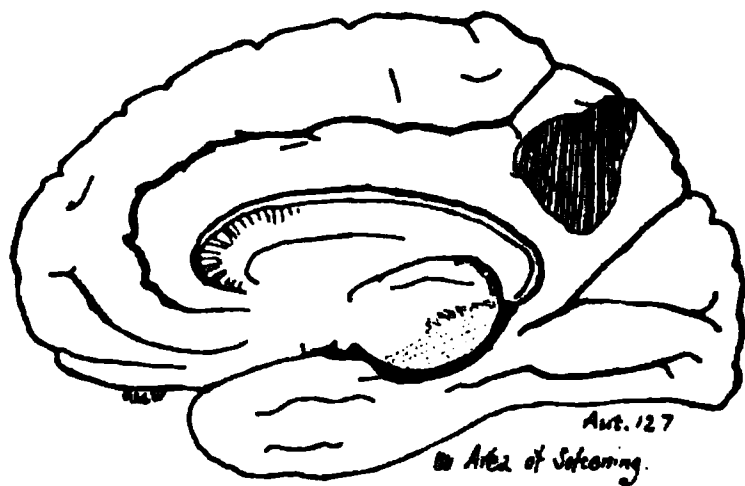


scious. On 21st had one convulsion—was dull and apparently blind. He remained without much change till December 25th, 1894, when he again began to have convulsions with spasmodic twitching of muscles of left side. He rapidly grew worse and died on afternoon of that date.

AUTOPSY. *Head*—Skull showed no special thickening and was deeply eroded in three places by Pacchionian bodies which were considerably enlarged. Dura abnormally adherent to skull and also to arachnoid over vertex in region of Pacchionian bodies. There was fluid in and beneath the layers of the pia-arachnoid,

but the membranes were not thickened and were clear except for some opacities near the larger vessels. Pia adherent to cortex.

Brain—Weight 47 oz., many erosions over convolutions of temporal and occipital lobes with a few over frontal. On the surface of right hemisphere there was a triangular softened area in precuneate lobe, the edges of which were about one and one-half inches in length. In depth it measured about one-eighth of an inch. Over this area the pia was very adherent and could not be removed without eroding brain. The convolutions showed no atrophy, but there was some flattening of entire hemisphere, showing moderate softening. There were no gross lesions of the basal ganglia, pons or medulla.



Lungs—Both congested; old pleuritic adhesions on left side.

Heart—Weight $9\frac{3}{8}$ oz., left ventricle thickened, valves smooth and of normal thickness.

Liver—Weight 53 oz., soft, friable, capsule adherent.

Kidneys—Weight of left $5\frac{3}{8}$ oz., of right $4\frac{1}{4}$ oz. These with *Spleen* showed no pathological changes.

AUTOPSY No. 130, CASE No. 1385.—Male, aged 40, single; nativity, United States; painter and paperhanger; heredity, father had general paralysis; duration of insanity, three years (?). Complication, cerebral compression. Cause of death, general paralysis.

Symptoms.—Patient was admitted January 18th, 1894, was incoherent, demented, ataxic in speech and gait, loss of facial expression, untidy in habits. March, 1894—He is happy, elated, grates teeth, demented, developed hæmatoma auris. October, 1894—Has had several paralytic seizures followed by a series of convulsions. From this time on patient grew rapidly worse, losing all control of sphincters, developed bed-sores and death occurred January 9th, 1895.

AUTOPSY. *Head*—Skull cap thickened. Dura thickened but not adherent. On incising dura about 7 oz. of fluid escaped. Pia, pale, thickened and adherent over parietal and occipital lobes of both hemispheres.

Brain—Weight 42 oz., cortex eroded, brain substance soft with punctate hemorrhages; gray matter thinned.

Lungs—Congested.

Heart—Weight 8 oz., left ventricle hypertrophied, aortic valves thickened. Right ventricle thin and flabby.

Liver, Spleen and Kidneys showed no gross pathological changes.

AUTOPSY No. 131, CASE No. 1583.—Male, aged 31 years 10 months, single, blacksmith, nativity, England; duration of insanity, one year and nine months. Complication, epilepsy. Cause of death, epilepsy.

AUTOPSY. *Head*—Skull cap dense and irregularly thickened. Dura thick and adherent to skull and pia on either side of the longitudinal fissure over Pacchionian bodies. Pia slightly thickened, clear except in a few small places over convexity. It was very adherent over the 1st, 2d, 3d and ascending frontal convolu-

tions of both hemispheres. At the base there were adhesions over the whole surface of the orbital and temporo-sphenoidal lobes.

Brain—Weight 45 oz., cortex over frontal lobes much eroded. Brain substance markedly softened throughout, convolutions much atrophied, small arteries of brain toughened, linings of ventricles smooth. Cerebro-spinal fluid not quite 2 oz.

Lungs—Right adherent to diaphragm, middle and lower lobes much congested, the lower portion of lower being consolidated. The left was congested but not consolidated.

Heart—Weight 13 oz., muscle soft. Mitral and aortic valves thickened.

Liver—Weight 58 oz., soft, capsule adherent to diaphragm and cortex.

Spleen—Weight $2\frac{1}{4}$ oz., very soft.

Kidneys—Weight of left $6\frac{1}{2}$ oz., of right $5\frac{3}{4}$ oz., capsules not adherent, surfaces smooth, cortices of good thickness, markings distinct.

AUTOPSY NO 144, CASE NO. 965.—Male, aged 53, widower, cigar-maker; nativity, Germany; duration of insanity (?). Complication, none. Cause of death, general paralysis.

AUTOPSY. *Head*—Skull cap thinned and softened. Dura pale and only slightly adherent to calvaria. Pia opaque, thickened and very adherent, causing many erosions upon removal.

Brain—Weight $42\frac{1}{2}$ oz., convolutions atrophied; sulci gaping; brain tissue softened. Arteries at base presented no pathological changes.

Lungs—Normal.

Heart—Weight $11\frac{1}{2}$ oz., cavities dilated, walls thickened and friable, aortic cusps thickened and at edges were several papillary nodules. Intima of aorta inflamed and roughened.

Liver—Weight 52 oz., congested.

Spleen and Kidneys were apparently normal.

AUTOPSY NO. 158, CASE NO. 1750.—Male, aged 56, married, grocer; heredity, half sister insane; duration of insanity, two years; nativity, United States. Complications, not any. Cause of death, general paralysis.

AUTOPSY. *Head*—Calvaria irregularly thickened and its inner surface roughened. Dura unusually thick, very tough and firmly adherent to calvaria. Pia-arachnoid adherent to dura in region of Pacchionian bodies; between it and dura were 5 oz. of fluid. Pia thickened over vertex and adherent over ascending frontal convolution of left side.

Brain—Weight 42 oz., frontal and orbital lobes markedly atrophied and their superficial surfaces roughened by erosions. Nothing abnormal was found upon examination of basal ganglia, pons or medulla; arteries at base apparently normal.

Lungs—No pleuritic adhesions, posterior portion of lower lobes markedly congested.

Heart—Weight $11\frac{3}{4}$ oz., both ventricles contained organized blood clots; at base of bicuspid valve were a few calcareous plaques. In the beginning of arch of aorta were small atheromatous patches.

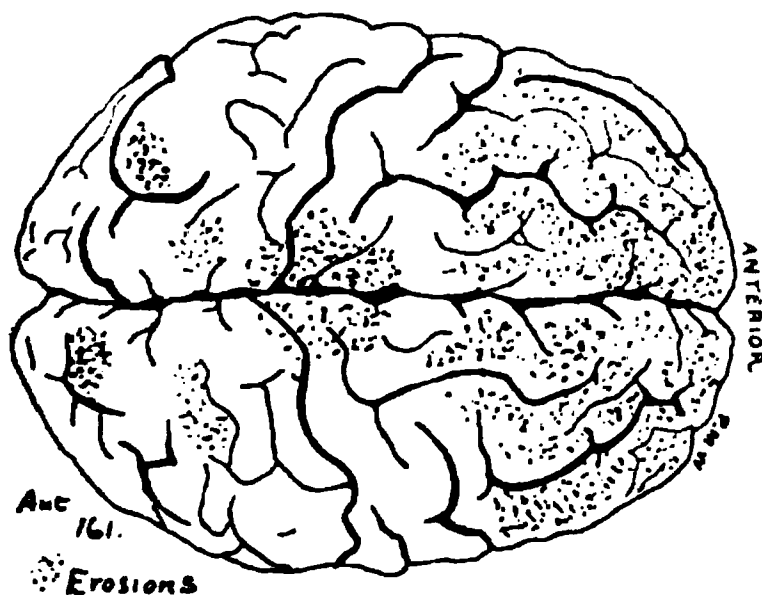
Liver—Weight $53\frac{1}{2}$ oz., soft, capsule adherent.

Spleen—Weight $4\frac{1}{2}$ oz., soft, dark and friable.

Kidneys—Weight of left $4\frac{1}{2}$ oz., of right $4\frac{3}{4}$ oz., capsules stripped readily, surfaces smooth; section showed them to be congested and the markings indistinct.

AUTOPSY No. 161, CASE No. 1312.—Female, aged 50, married, housework; nativity, United States; duration of insanity, twenty months. Complication, not any. Cause of death, general paralysis.

AUTOPSY. *Head*—Skull of normal density and thickened. Dura not unduly adherent. Pia adherent to dura in region of Pacchionian bodies. Thick, tough and adherent to cortex over anterior lobes generally; also over para-central lobules on both sides and in region of parieto-occipital fissure.



Brain—Weight 34 oz., cortex eroded, brain substance soft, flattened by its own weight, anterior lobes firmly agglutinated in anterior portion of longitudinal fissure. The isle of Reil on both sides was markedly softened. The lateral ventricles were dilated and filled with serum. Vessels at base were markedly calcareous.

Lungs—Left bound to chest wall at apex, right so adherent to parietes that it was impossible to remove it. It was of deep red color and of the consistency of liver.

Heart—Weight $8\frac{1}{4}$ oz., muscle flabby, aorta contained atheromatous patches and calcareous deposits.

Spleen—Weight $1\frac{1}{2}$ oz., very small and extremely firm.

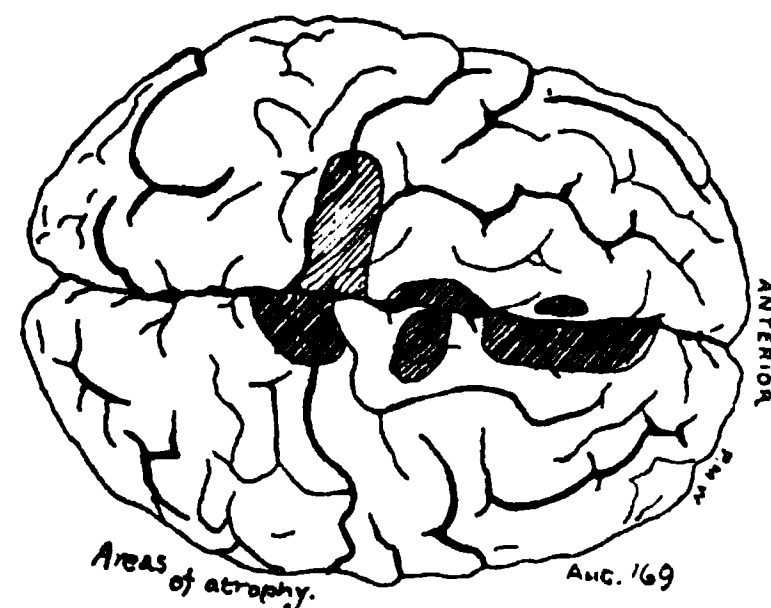
Kidneys—Weight of left $3\frac{3}{4}$ oz., of right $3\frac{3}{4}$ oz., capsules slightly adherent. On section structure was found to be dark red in color with markings fairly distinct.

AUTOPSY No. 169, CASE No. 1017.—Female, aged 43, married, housewife; nativity, United States; heredity, aunt insane; duration of

insanity, six years. Complication, syphilis. Cause of death, general paralysis.

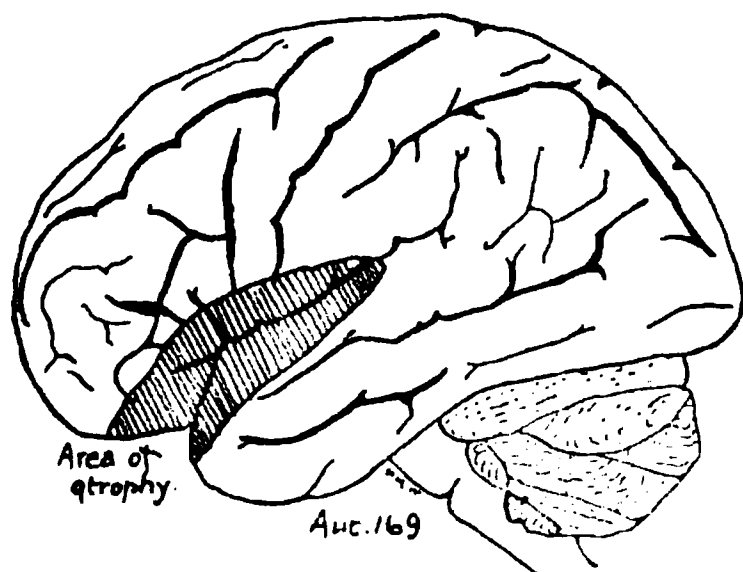
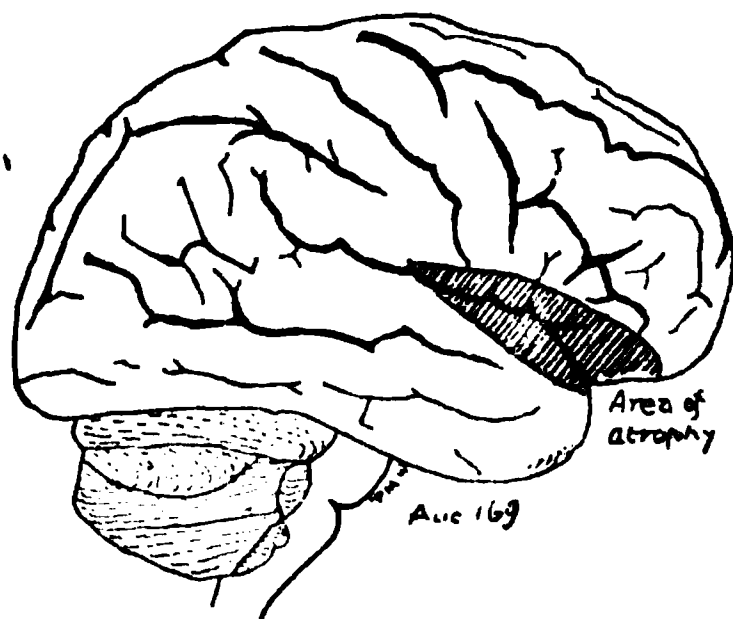
AUTOPSY. *Head*—Skull dense but not thickened. Pia adherent over vertex and when removed caused erosions. Between pia and arachnoid were many lakelets of serum.

Brain—Weight 39 oz., numerous erosions at cortex,



convolutions atrophied and depressed; sulci broad. The fissure of Sylvius on either side was broad and shallow and the bordering convolutions atrophied.

Lungs—Left adherent to pericardium, upper lobe consolidated with numerous tubercular foci. Right lung presented pleuritic adhesions at base and apex.



Kidneys—Weight of left $3\frac{3}{4}$ oz., of right $4\frac{1}{2}$ oz., both capsules adherent and both kidneys contracted.

AUTOPSY No. 176, CASE No. 538.—Male, aged 38, married, farmer; nativity, United States; duration of insanity, four years. Complication, phthisis pulmonalis. Cause of death, phthisis pulmonalis.

AUTOPSY. *Head*—Not examined.

Heart—Weight $8\frac{1}{2}$ oz., muscle friable and pale in color, aortic valve slightly roughened by vegetations. Pericardium adherent to

heart at base. The pericardial cavity contained $1\frac{1}{2}$ oz. of fluid. In ascending portion of arch of aorta were numerous patches of atheromatous degeneration.

Lungs—Pleuritic adhesions existed over entire right lung so that it was removed with great difficulty. The upper lobe was a mere shell its cavity traversed by trabeculae and bronchioles. The lower lobes contained many areas of tubercular degeneration and were crepitant only in part. In lower lobes of left lung was a large irregular cavity surrounded by small areas of consolidation due to tubercular processes.

Liver—Weight 57 oz., firm, pale, connective tissue increased.

Kidneys—Weight of left $4\frac{1}{2}$ oz., of right 5 oz., surfaces smooth, pale, section showed the tissue to be anæmic.

Spleen—Weight $7\frac{1}{2}$ oz., no gross change.

AUTOPSY No. 178, CASE No. 1716.—Male, aged 46, single, laborer, nativity, Ireland; duration of insanity, six months. Complications, absent. Cause of death, general paralysis.

AUTOPSY. *Head*—Skull thin, dura pale, pia opaque, thickened and adherent, causing many erosions of cortex when removed.

Brain—Weight $44\frac{1}{2}$ oz., greatly softened, the hemispheres separating by their own weight. Many superficial erosions existed over entire cortex. The large blood vessels showed numerous areas of opacity and thickening.

Lungs—Left normal, the right was so bound down by pleuritic adhesions that it was badly torn in the attempt to remove it.

Heart—Weight $5\frac{1}{8}$ oz., small, tissue firm, endocardium discolored.

Kidneys—Weight of left $3\frac{1}{2}$ oz., of right 3 oz., capsules firmly adherent, organ very firm, connective tissue much increased.

Liver—Weight $20\frac{1}{2}$ oz., extremely small and contracted.

Spleen—Weight $1\frac{7}{8}$ oz., it was also very much contracted and diminutive in size.

AUTOPSY No. 180, CASE No. 2238.—Male, aged 24, single, laborer, nativity, United States; duration, five years(?). Complication, not any. Cause of death, general paralysis.

AUTOPSY. *Head*—Skull cap of average thickness but very dense; membranes so adherent that entire encephalon was removed with calvaria. Dura thickened and adherent. Pia presented a milky appearance and was marked by streaks of opacity along the course of the vessels, and when removed it caused many erosions of the convolutions.

Brain—Outer portions of the convolutions were softened. The frontal lobes were adherent to each other in longitudinal fissure, as also were the frontal and temporo-sphenoidal at base of Sylvian fissure.

Lungs—Congested and oedematous.

Heart—Small, contracted and surface covered by a considerable quantity of fat. The coronary vessels were thickened and aortic intima roughened. The mitral valve was smooth and clear. At base of aortic valve was a small calcareous deposit, which, however, did not interfere with the action of the valve.

Liver—Congested and of dark chocolate color.

Kidneys—Capsules adherent, fibrous tissue greatly increased, cortices rather pale.

AUTOPSY No. 181, CASE No. 2036.—Male, aged 56, married, farmer; nativity, United States; duration of insanity, two years. Complication, not any. Cause of death, general paralysis.

AUTOPSY. *Head*—Skull of average thickness and density. Dura abnormally adherent to calvaria along superior longitudinal fissure. Between pia and arachoid was a considerable quantity of fluid. The pia was milky, this milky appearance being most marked along the fissure of Rolando and over convexity of brain. It was universally adherent to cortex. The blood vessels at base and throughout brain were thickened.

Heart—Weight 12 oz., left ventricle hypertrophied; aortic cusps thickened and calcareous.

Liver—Weight, 38 oz., soft though small.

Kidneys—Weight of left $4\frac{1}{2}$ oz., right 4 oz., cortices thin, connective tissue slightly increased.

Spleen—Weight $3\frac{3}{8}$ oz., no noticeable change.

AUTOPSY No. 182, Case No. 2031.—Male, aged 38, single, laborer; nativity, United States; heredity, brother insane; duration of insanity, three years eight months. Complication, not any. Cause of death, general paralysis.

AUTOPSY. *Head*—Skull of average thickness but dense and brittle. Dura adherent to calvaria and to arachnoid along superior longitudinal fissure. Pia, arachnoid opaque, the subarachnoidean fluid much increased. Pia itself much thickened; its vessels tough. It was adherent to brain at apex of temporo-sphenoidal lobe.

Brain—Weight 47 oz. Aside from a few erosions no gross changes were noticed.

Lungs—Somewhat oedematous with hypostatic congestion posteriorly.

Heart—Weight $9\frac{1}{2}$ oz., normal.

Liver—Weight, 52 oz.

Spleen—Weight $3\frac{3}{4}$ oz.

Kidneys—Weight of left $6\frac{1}{4}$ oz., of right $5\frac{1}{2}$ oz. No gross changes in these organs.

AUTOPSY No. 185, CASE No. 2217.—Male, aged 47, married, house-keeper; nativity, United States; heredity, aunt insane; duration of

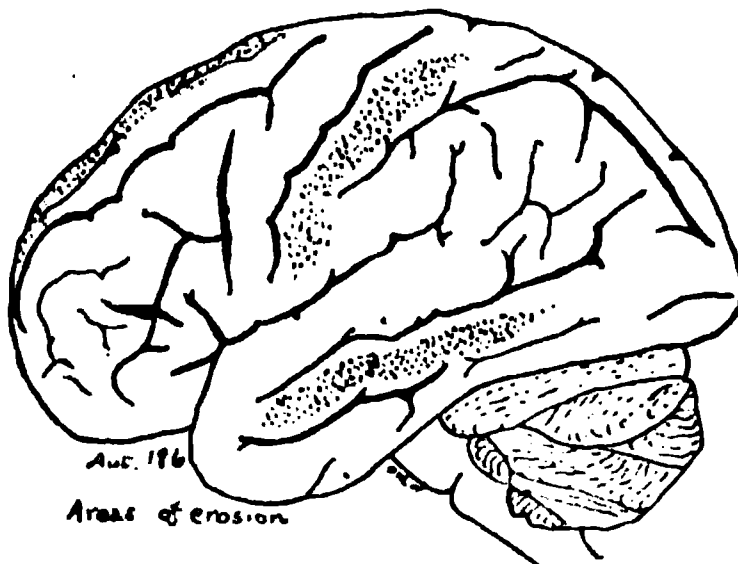
insanity, four months. Complications, not any. Cause of death, general paralysis.

AUTOPSY, Head—Calvaria presented no abnormalities. Dura firmly adherent along longitudinal sinus but normal in appearance; cerebro-spinal fluid increased. Pia thickened, opaque, and adherent to occipital lobes, tip of right frontal and at base in fissure of Sylvius. It was of unequal thickness, being unusually thick anteriorly and thin posteriorly.

Brain—Weight $51\frac{1}{4}$ oz. There were a few erosions at those points where the pia was adherent. At base, near the pons on right side, was a small area of softening and surrounding it were small granulations about the size of shot. Remaining organs presented no gross lesions.

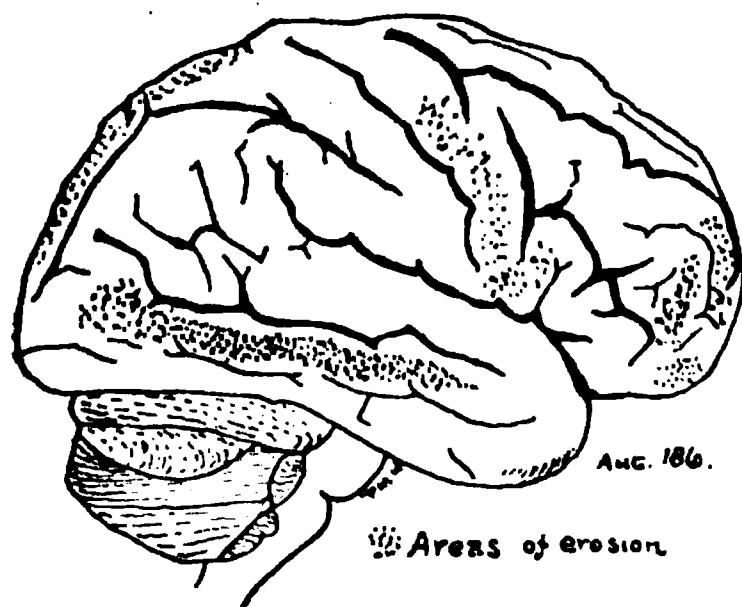
AUTOPSY No. 186, CASE No. 1799.—Male, aged 49, married, book-keeper; nativity, Canada; duration of insanity, three years (?). Complication, pneumonia. Cause of death, pneumonia; contributing cause, general paralysis.

AUTOPSY. Head—Calvaria of average density and thickness. Dura quite adherent along superior longitudinal fissure. Pia thick, adherent to cortex and opaque along the course of the vessels.



Brain—Weight $43\frac{1}{2}$ oz.; many erosions existed along Sylvian fissure, ascending frontal and parietal convolutions; also over second

temporo-sphenoidal convolution. Marked atrophy of these convolutions had occurred beneath the erosions. The interior of the brain and the basal ganglia presented no gross changes. Remaining organs normal

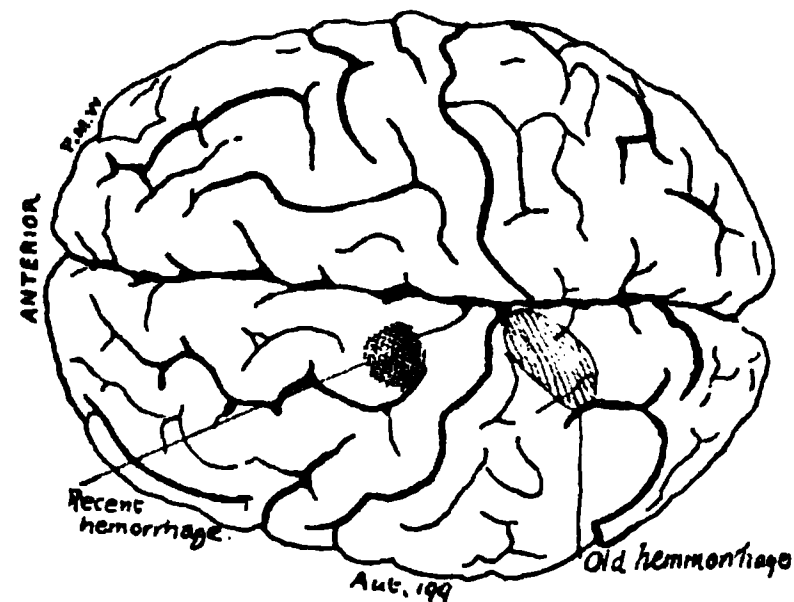


AUTOPSY No. 199, CASE No. 2380.—Male, aged 55, married, merchant; nativity, United States; heredity, four paternal uncles, two cousins and an elder brother insane; duration of insanity, two years.

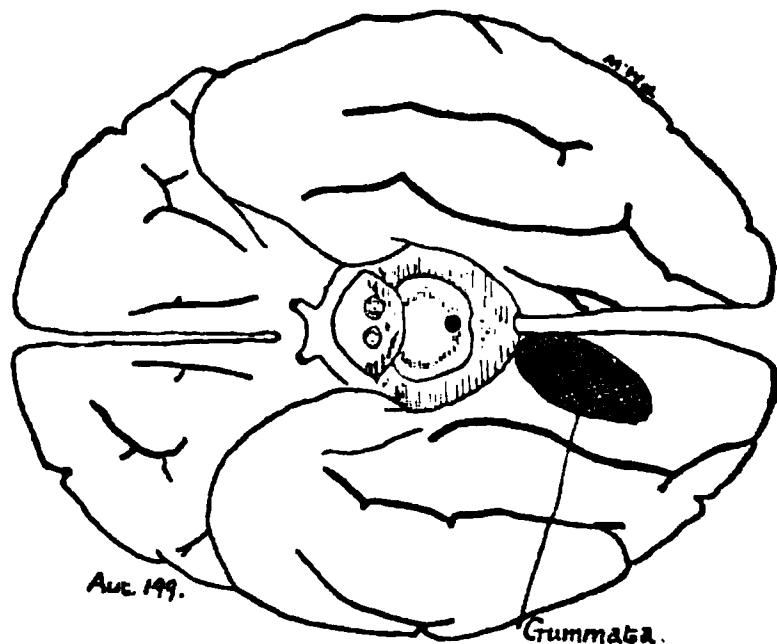
Complications, syphilis and chronic interstitial nephritis. Cause of death, general paralysis.

Symptoms.—The earliest symptoms were loss of memory for recent events and inattention to business with impairment of judgment. Formerly of a quiet and unobtrusive temperament, he now became eccentric, noisy and changeable. Complained of head- and stomach-

ache with insomnia. Had hallucinations of sight, frequently seeing persons who had been dead many years. Later he developed erotomania. These symptoms now became more pronounced, his judgment and memory becoming weaker; he became apathetic, answered questions slowly, had tremor of hands, and tongue when



protruded. Walked slowly with a tendency to drag his feet upon the floor. Later he became incoherent, confused, speech thick and ataxic, gait ataxic and hesitating, both pupils dilated, the left greatly. Later he became very weak both mentally and physically, and was kept in bed. About two weeks before his death he developed partial paralysis of left arm. He had retention of urine and was catheterized daily, this becoming so difficult it was finally found necessary to aspirate bladder. This latter operation was performed twice previous to death.



AUTOPSY. Head—Skull somewhat asymmetrical, frontal bones abnormally thick. Dura congested but not unusually adherent to skull cap. Pia congested, waterlogged, and adherent to convolution in many places.

Brain—Weight, 49 oz., firm, gray matter of normal thickness, though the convolutions over the greater part of brain surface were markedly flattened. The right ascending parietal convolution contained a recent hemorrhagic clot about the size of a pea and situated about half an inch from superior longitudinal fissure. An area of softening caused by a former clot was found in the vicinity of angular gyrus. A syphilitic gumma the size of a walnut was found

at base of brain posterior to right optic thalamus. The posterior communicating artery on right side was dilated, while on the left it was nearly obliterated. The lateral ventricles were dilated and filled with serum, each choroid plexus being cystic.

DEMENTIA—THIRTY-SIX CASES.

AUTOPSY No. 102, CASE No. 69.—Male, aged 69, married, farmer; nativity, United States; duration of insanity, eight years, six months; (present attack, four years, six months). Complications, chronic nephritis and acute enteritis. Cause of death, acute enteritis.

AUTOPSY. *Head*—Skull cap of average thickness and density. The membranes were thickened and the pia was cloudy and infiltrated, while its surface was dotted with numerous small hemorrhagic areas. Its vessels were dilated and engorged with venous blood.

Brain—Weight $5\frac{1}{4}$ oz.; convolutions thin and narrow but well defined. Upon section the brain appeared to be of normal consistence, but the vessels were distended and plainly visible to the unaided eye.

Heart and Lungs—Normal.

Liver—Weight $4\frac{1}{2}$ oz.; edges thin, structure firm and fibrous.

Kidneys—Weight of left $3\frac{7}{8}$ oz., of right $3\frac{3}{8}$ oz.; capsules adherent; surfaces, nodular; structure, firm and fibrous.

Spleen—Weight $2\frac{3}{4}$ oz., soft and friable.

Intestines—The lower part of the ileum and upper portion of colon were much congested. The mucous membrane was of very dark color, ecchymotic in areas, almost gangrenous in appearance, and in some places ulcers were found.

AUTOPSY No. 103, CASE No. 1772.*—Female, aged 16, single, student; nativity, United States; alleged cause, cerebral hemorrhage; duration of insanity, fourteen months. Complication, not any. Cause of death, cerebral apoplexy and meningitis.

Clinical History—Patient was admitted to the hospital July 26, 1894, in a very feeble condition. The father states that "About one year ago he noticed that it was harder than usual for her to learn her lessons and it was thought best to take her from school. Shortly after this it was noticed that she was very nervous and twitching of the mouth occurred when speaking. In January, 1894, she had a partial stroke of paralysis, and since that time has failed rapidly, both mentally and physically."

She has been in bed continuously since admission. Temperature oscillated between 97° and 103.4° , not varying more than a degree in twenty-four hours, except on September 10, when it rose from 101° to

* This case was reported as a case of *hydrocephalus ex vacuo*, in the Eighth Annual Report of the St. Lawrence State Hospital, p. 147, by Dr. J. M. Mosher.

103.4°. The day before her death patient had several convulsive seizures followed by paralysis. From this time on she failed rapidly and died on the twelfth with temperature 101.3°.

AUTOPSY. *Head*—The skull cap was of average density and thickness and upon its removal 7 oz. of discolored fluid escaped. This

came from the former site of right occipital lobe which was found to be absent. The dura was not thickened or adherent, but the pia was adherent generally over the brain surface, thick, engorged with blood, and in several places the intense ingestion was accompanied by localized areas of small clots lying beneath the membrane. The course of the

vessels was marked by whitish opacities. The circle of Willis on left side was well developed, but on right side its vessels were so small that it was with much difficulty the posterior and middle cerebral vessels were found. On the left side at the junction of the middle cerebral and internal carotid and extending forward to the anterior communicating artery was an irregular patch of arterial degeneration, and in this was a small branching thrombus covered with fresh coagulum.

Brain—Showed many erosions on cortex and the frontal lobes were agglutinated at genu of corpus callosum. Weight 40½ oz.

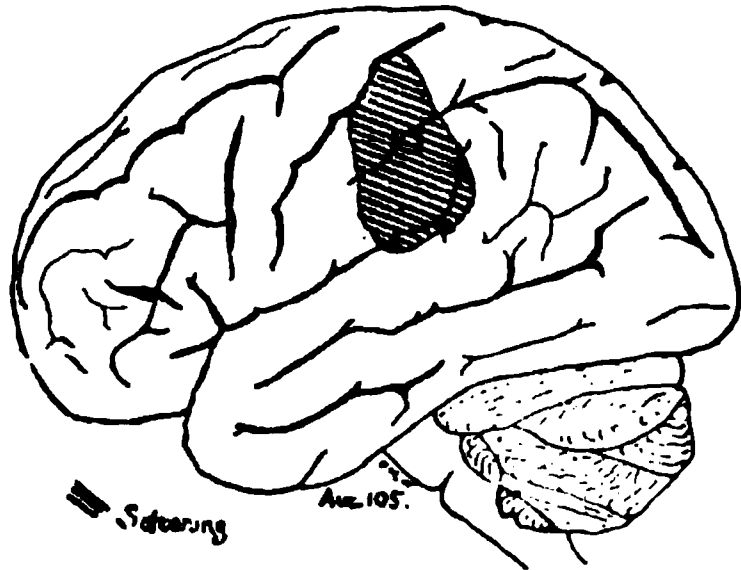
Frontal lobes.

The right hemisphere was badly disorganized, the right occipital lobe, as indicated above, being entirely absent and its place occupied by a bloody fluid. The degeneration extended from the occipital lobe forward, on the under surface of the brain, nearly to the fissure of Sylvius. An incision here laid open the lateral ventricle, lying directly beneath the membranes, no cortical substance intervening. Other organs examined but no special pathological change noted.

AUTOPSY No. 105, CASE No. 1293.—Female, aged 78, widow, housewife, nativity, Germany; duration of insanity, three years and eight

months. Complications, embolism and thrombosis of middle cerebral artery. Cause of death, embolism of middle cerebral artery.

This case presented no noteworthy symptoms until a few days before death, when she suddenly became unconscious, and right side of face, arm and hand paralyzed. She regained partial consciousness, but did not recover the power of speech or motion.



AUTOPSY. *Head*—Skull thicker than usual but less dense. Dura thickened and firmly adherent to calvarium so that it was badly torn upon removal of skull cap. Pia thickened but not adherent. The vessels were atheromatous, especially at the base, and opacities marked their course.

Brain—Weight $41\frac{1}{4}$ oz.; an extensive area of softening was found on the left side involving a portion of the motor area and extending downward and backward toward the upper end of the horizontal limb of the Sylvian fissure. (See chart.) In the vessel supplying this softened area was found an embolus which completely occluded its lumen.

Heart—Walls of left ventricle slightly thickened, mitral valve normal, but on the aortic surface of the aortic semilunar valves were found numerous vegetations.

Lungs—Congested and emphysematous.

Liver—Fatty.

Other organs presented no special pathological change.

AUTOPSY NO. 107, CASE NO. 1126.*—Female, aged 59, widow, housewife; nativity, Ireland; duration of insanity, twenty years. Complication, dysentery. Cause of death, dysentery.

AUTOPSY. *Head*—Calvaria normal, membranes slightly thickened and adherent to cortex along longitudinal fissure. Vessels of the pia injected and opacities marked their course.

Brain—Weight $40\frac{1}{2}$ oz., over the right superior frontal convolution, at about its middle, antero-posteriorly, was a cyst of the membranes. Under this was a clean-cut excavation nearly one inch in length and extending down as deep as the base of the convolution. No other pathological conditions found.

Lungs—Normal.

* "This case is quite remarkable in that the patient while living presented no symptoms indicative of the grave lesion found in brain."

Heart—Weight $7\frac{1}{2}$ oz., pale in color and very friable, valves normal. Abdominal organs small, but with the exception of the large intestine presented no pathological change.

Liver—Weight $30\frac{3}{4}$ oz.

Spleen—Weight $2\frac{1}{4}$ oz.

Kidneys—Left $3\frac{1}{4}$ oz., right $2\frac{1}{2}$ oz.

Colon—Walls thickened and hyperæmic; lymphatics of same distended, blood vessels injected.

AUTOPSY No. 108, CASE No. 31.—Male, aged 30, single, occupation (?); nativity, Ireland; duration of insanity, unascertained. Complication, dysentery. Cause of death, dysentery.

AUTOPSY. *Head*—Skull of normal thickness and density.

Brain—Weight 51 oz., firm, well formed, but anæmic in appearance. Dura normal; pia thin with slight opacities along the course of the larger vessels, not adherent, stripping easily.

Lungs—Normal.

Heart—Weight $11\frac{3}{4}$ oz., muscular tissue friable, valves competent.

Liver—Weight $68\frac{1}{2}$ oz., soft, edges dull; upon section was found to be congested and granular in appearance.

Kidneys—Weight of left $5\frac{3}{4}$ oz., of right 5 oz., cloudy; capsule free.

Spleen—Weight, $1\frac{7}{8}$ oz., firm.

Small Intestine—Pale and dry.

Large Intestine—Mucous membrane very dark in color with various areas of necrotic tissue. The wall as a whole was thickened and infiltrated, the mesenteric glands enlarged, softened and reddish gray in color.

AUTOPSY No. 109, CASE No. 1709.—Female, aged 46, single, occupation, not known; nativity, United States; duration of insanity, thirty-five years. Complication, dysentery. Cause of death, dysentery.

AUTOPSY. *Head*—Calvaria thin and brittle; dura pale; vessels collapsed; pia not adherent, but presenting slight opacities along superior longitudinal and Sylvian fissures.

Brain—Weight 37 oz., firm, anæmic, convolutions atrophied, sulci shallow and gaping.

Lungs—Normal.

Heart—Weight 8 oz., muscle friable, valves competent.

Liver—Weight $37\frac{1}{2}$ oz., soft and friable.

Spleen—Weight $3\frac{1}{8}$ oz., firm.

Small Intestine—Dry and adherent, mesentery injected.

Colon—Walls thickened and infiltrated; mucous membrane black, with necrotic areas; granular exudate and shreds of membranes were found upon its surface.

AUTOPSY No. 110, CASE No. 1675.—Male, aged 54, married, laborer; nativity, (?); duration of insanity, ten years and five months. Complication, dysentery. Cause of death, dysentery.

AUTOPSY. *Head*—Skull cap thin and translucent, dura pale, vessels collapsed. Pia oedematous, opaque along superior longitudinal fissure; not adherent. Large vessels at base of brain marked by small opaque areas.

Brain—Weight $38\frac{7}{8}$ oz., firm, sulci shallow, convolutions rudimentary.

Lungs—Apex of left consolidated, firm and fibrous, right lung normal.

Heart—Weight $11\frac{1}{2}$ oz., walls thin and friable, slight thickening of aortic valves with roughening of aortic endocardium; small vegetations along their free borders. Remaining valves normal.

Liver, Kidneys and Spleen—Normal.

Small Intestine—Dry and adherent.

Large Intestine—Oedematous, mucous membrane very dark in color, ragged, gangrenous in places with necrotic areas. Descending colon almost denuded of mucous membrane

AUTOPSY No. 115, CASE No. 1574.—Female, aged 84, widow, housewife; nativity, Ireland; duration of insanity, two and one-half years. Complication, intracapsular fracture of hip. Cause of death, shock resulting from intracapsular fracture of neck of femur.

AUTOPSY. *Head*—Calvaria thick but not unusually hard. The dura was very adherent to the skull, and in these adhesions calcareous salts had been deposited. Removal of the pia caused erosion of cortex and the escape of a large quantity of bloody serum.

Brain—Weight 32 oz., cortex eroded, brain small, shrunken and atrophied. The convolutions were very small, in some places being only a few lines in thickness. The sulci gaped widely. The arteries were wiry, tortuous, atheromatous in patches, while calcareous deposits and fusiform dilatations were common.

Lungs—Congested and oedematous.

Heart—Weight 10 oz., left ventricle hypertrophied and dilated. In one segment of the mitral valve, at its base, was a calcareous deposit. Calcareous plates were also found on the aortic valves.

Aorta—Enlarged, intima roughened and at the aortic bifurcation were numerous atheromatous patches with calcareous deposits.

Liver—Weight 38 oz., no gross pathological change discovered.

Spleen—Weight $4\frac{1}{2}$ oz., soft and pulpy.

Kidneys—Weight of left $4\frac{1}{2}$ oz., of right $3\frac{3}{4}$ oz., small, pale, and the cortical and medullary portions ill defined. Capsules of each adherent.

Uterus—Contained a small fibroid.

AUTOPSY No. 118, CASE No. 652.—Female, aged 57, widow, domestic; nativity, England; duration of insanity, two and one-half years. Complication, chronic nephritis. Cause of death, pulmonary œdema following chronic nephritis.

AUTOPSY. *Head*—Skull thick but less dense than usual. Dura thickened and so adherent to calvaria that it was with great difficulty that they separated. Pia thickened and œdematous, upon its under surface was found a jelly-like deposit which had not yet become organized.

Brain—Weight 35 oz., small, anæmic, sulci shallow. Two small tumors of roundish outline and one-half inch in diameter attached to dura, encroached upon the anterior lobe of right side causing marked depression. Brain substance proper was softened. This was especially noticeable at the base, where the optic chiasm, crura cerebri, and optic thalami were quite pale and soft.

Lungs—Upper lobes of both were congested. At the apex of left were old tubercular scars, right was adherent to diaphragm.

Heart—Weight 12 oz., cavities filled with clotted blood, muscular tissue and valves normal.

Liver—Weight $43\frac{1}{2}$ oz., fatty degeneration well marked. Right lobe adherent to diaphragm. About three inches from right border, and on its upper or diaphragmatic surface, was an old abscess cavity filled with cheesy and calcareous material.

Spleen—Weight $2\frac{3}{4}$ oz., small, very soft.

Kidneys—Weight of left $2\frac{3}{4}$ oz., of right 3 oz., cortex thinned, capsules adherent, surface pale.

AUTOPSY No. 121, CASE No. 165.—Female, aged 54, married, housewife; nativity, Ireland; duration of insanity, twenty-four years. Complication, chronic nephritis. Cause of death, chronic nephritis.

AUTOPSY. *Head*—Calvaria of average thickness and density and upon its removal a small quantity of bloody serum escaped. Membranes slightly thickened and adherent along longitudinal fissure. The pial vessels were congested and along their course opacities were seen.

Brain—Weight $45\frac{3}{4}$ oz., sulci gaping, convolutions atrophied and very thin; beyond these no other pathological changes were observed.

Lungs—Left adherent to chest wall anteriorly, the right posteriorly was bound down by many adhesions.

Heart—Weight $7\frac{3}{4}$ oz., with the exception of slight thickening of the mitral valves no pathological change was noted.

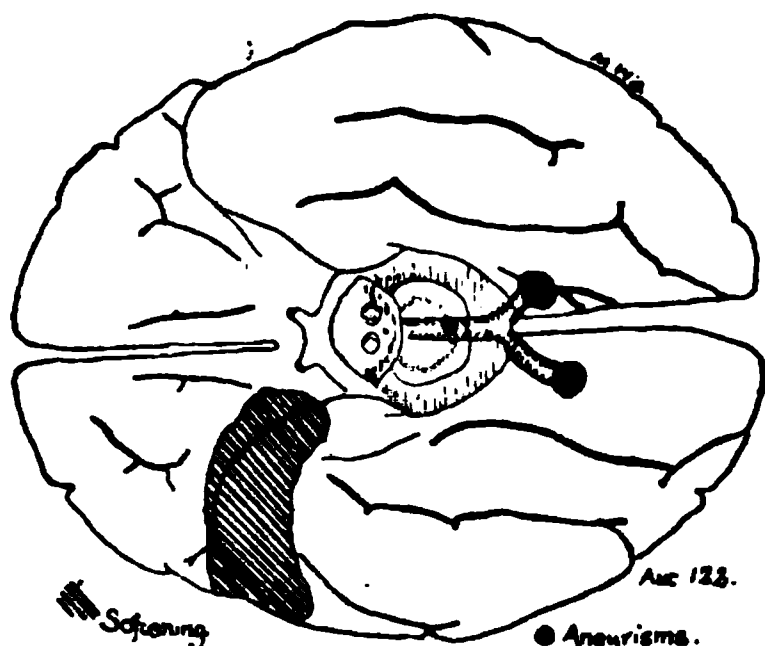
Liver—Weight $30\frac{1}{4}$ oz., small, surface mottled, capsules adherent.

Spleen—Weight 3 oz., soft, very friable.

Kidneys—Weight of left $3\frac{3}{4}$ oz., of right $3\frac{1}{2}$ oz., capsules thickened and adherent, surface mottled, cortices thin, pale, firm and fibrous.

AUTOPSY No. 122, Case No. 1663.—Male, aged 59, civil condition (?) shoemaker; nativity, Ireland; duration of insanity, thirty-five years. Complication, varicose veins of lower extremities. Cause of death, cerebral hemorrhage.

AUTOPSY. *Head*—Skull of average density and thickness. Dura not thickened or adherent. Pia considerably thickened and its under surface roughened but not adherent.



Brain—Weight, 46 oz. Vessels showed marked degeneration of their walls, whitish, hardened patches appearing here and there along their course. At the base the changes were more marked, and on the vertebral arteries, one inch below their point of union, circumscribed dilatations were found. The middle cerebral artery of right side also showed marked degeneration. About one

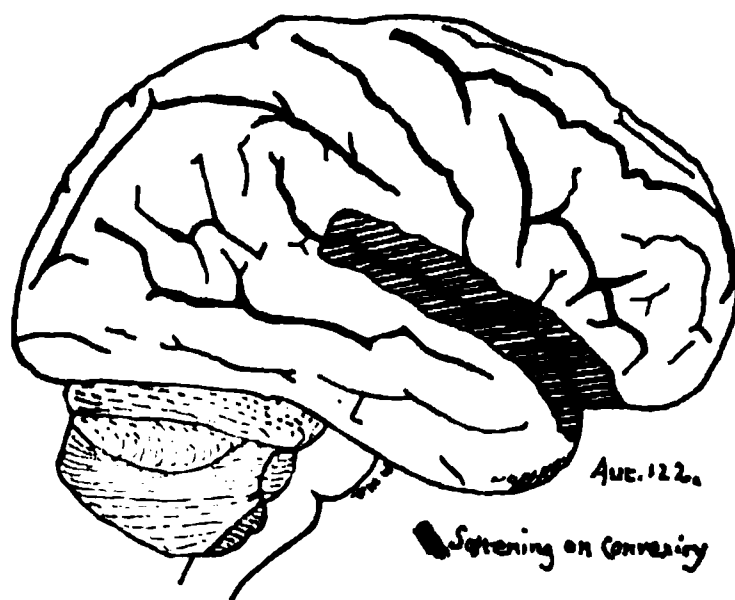
inch above the origin of the Sylvian fissure, a clot was discovered, which, upon further examination, was found to fill the entire lateral ventricle of that side and to have originated in the corpus striatum. An area of softening extended along the course of the middle cerebral artery, almost the entire length of the fissure and deeply involved the basal ganglia.

Lungs—A few slight pleuritic adhesions and hardened plates in walls of the bronchi, were the only pathological changes noted.

Heart—Weight 21½ oz. Ventricle of left side much thickened, the wall being 1¾ inches in thickness; valves slightly thickened but competent. At base of aortic semi-lunar valves and in the beginning of arch of aorta, atheromatous patches were found. Pericardium quite adherent at base and apex.

Liver—Weight 48½ oz.; congested and friable.

Kidneys—Weight of left 4¾ oz., of right 7¾ oz. The right was far advanced in cystic degeneration. One large cyst situated at its upper extremity and two smaller ones below, nearly covered its



entire surface, so that it retained little of its original appearance. Capsule of left was adherent and its cortex extremely thin. Remaining organs normal.

AUTOPSY No. 123, CASE No. 1191.—Male, age (?), civil condition (?), occupation (?); nativity (?); duration of insanity, (?). Complications, cerebral apoplexy, endocarditis and endarteritis. Cause of death, cerebral apoplexy.

AUTOPSY. *Head*—Calvaria of usual thickness with unusual adhesions to dura. Pia thickened and its vessels marked by opacities. Arteries at base were atheromatous, the basilar being thickened and nodular with fusiform dilatations.

Brain—Weight $49\frac{1}{2}$ oz. Convolutions flattened and attenuated. On the left side an area of softening extended from upper extremity of horizontal limb of Sylvian fissure, upward and backward, involving the supra-marginal and first temporo-sphenoidal convolutions. (See chart). This softened area was of brownish-red color, gelatinous in consistency, and surrounded by cicatricial tissue. It involved the cortex and dipped down deep into the white matter. The pia over this area was thick, tough and adherent. The ventricles contained an excess of fluid, the choroid plexuses were pale, translucent and of jelly-like consistence.

Lungs—Left, normal; upper portion of right bound down by strong adhesions.

Heart—Weight $10\frac{1}{2}$ oz.; muscular tissue firm; mitral and aortic valves thickened and nodular along their free borders. Aortic walls were thickened and dilated, its intima from aortic valves to iliac vessels was nodular, studded with calcareous plaques, and in places the membrane was eroded.

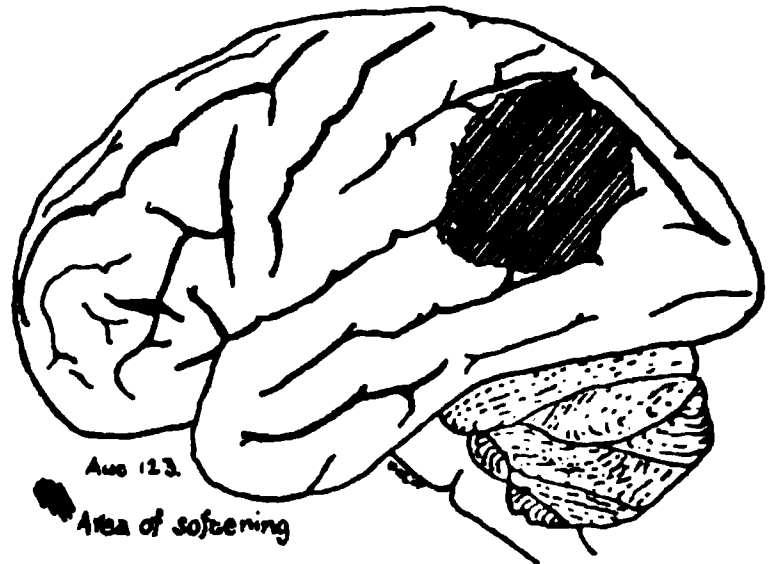
Liver—Weight $45\frac{1}{2}$ oz.; congested, granular and friable.

Kidneys—Weight of left $3\frac{3}{4}$ oz., of right 4 oz.; structure normal.

Spleen—Weight $2\frac{1}{2}$ oz.; structure of reddish-gray color and very soft. Its surface was covered with cartilage like bands of tissue.

AUTOPSY No. 125, CASE No. 1372.—Male, aged 59 (?), married, blacksmith; nativity, Germany; duration of insanity, nine years. Complication, acromegaly. Cause of death, peritonitis.

AUTOPSY. *Head*—Skull cap greatly thickened. Dura and pia clear, of normal thickness and not adherent. Serum normal in quantity.



Brain—Weight 49½ oz., compact, firm and of normal proportions. Ventricles contained little fluid. Pituitary body not increased in size to any noticeable degree. Internal carotids were thickened, this was not found to be the case in any of the other vessels.

Lungs—Right considerably congested, left only slightly.

Heart—Weight 12½ oz., firmly contracted; valves normal.

Liver—Weight 59 oz., congested.

Spleen—Weight 7¾ oz., quite firm.

Intestines—Distended with flatus, the coils very much inflamed, the inflammation extending to the peritoneum. In the right iliac fossa the intestines were adherent to the peritoneum and matted together by adhesions evidently of old date. Various patches of organized lymph dotted the intestines. Above the ileo-cæcal valve the intestines were filled with gas and fæcal matter; below they were empty. Appendix was adherent to cæcum, although it was included within the inflammation, it apparently was not the origin of it. The abdominal cavity contained a quantity of pus and serum. Remaining organs normal.

AUTOPSY No. 132, CASE No. 1336.—Female, aged 35, single, teacher; nativity, United States; heredity, one sister insane; duration of insanity, eight years. Complication, acute pulmonary tuberculosis. Cause of death, acute pulmonary tuberculosis.

AUTOPSY. *Head*—Skull cap of average thickness and density. Dura not thickened or adherent. Pia thin, soft, and its vessels injected. On incising membranes about 4 oz. of serum escaped.

Brain—Weight 43½ oz., of average consistence. Upon right frontal lobe was a small cyst; no other abnormalities were observed.

Lungs—Right firmly adherent to chest wall throughout; it was riddled with cavities and necrotic areas. Left was large, firm and scattered through its upper lobe and apex were tubercular nodules of various sizes, and in all stages of degeneration.

Heart—Weight 8 oz., muscle firm, intima of valves and aortic arch normal. Right auricle was distended with a fibrous clot, about which was freshly coagulated blood.

Liver—Weight 49 oz., pale, firm and greasy. Its surface was mottled presenting the characteristic nutmeg appearance.

Kidneys—Weight of left 5 oz., of right 4½ oz.; capsules stripped easily, markings distinct, cortices thickened at expense of pyramids.

Spleen and remaining pelvic organs presented no gross changes.

AUTOPSY No. 135, CASE No. 1329.—Female, aged 56, single, domestic; nativity, (?); duration of insanity, ten years. Complication, pulmonary tuberculosis. Cause of death, pulmonary tuberculosis.

AUTOPSY. *Head*—Not examined.

Lungs—Congested posteriorly. Tubercular lesions were found in upper lobes of both.

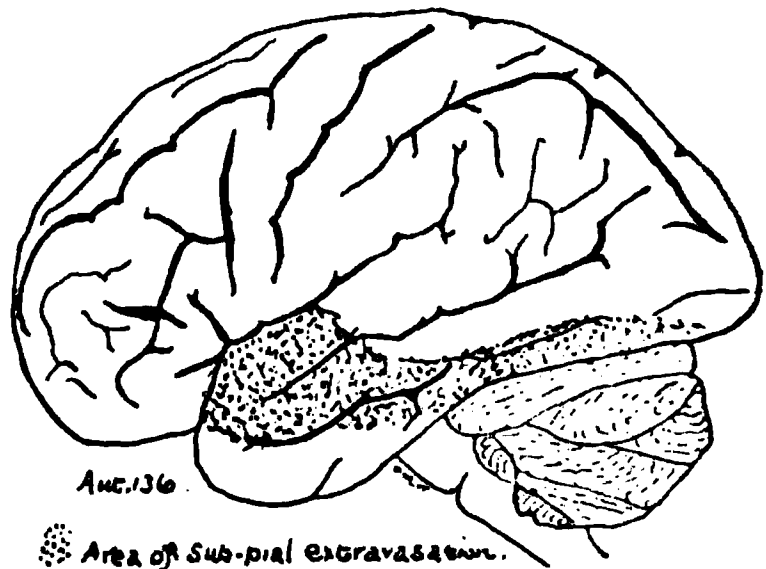
Liver—Weight $31\frac{1}{2}$ oz.; soft, small and adherent to diaphragm.

Spleen—Weight $2\frac{1}{4}$ oz.; bi-lobed, the smaller lobe being the size of a hazel-nut.

Kidneys—Weight of left $1\frac{1}{2}$ oz., of right $4\frac{1}{2}$ oz., and apparently normal. Left was very small and misshapen, was cystic and filled with caseous material, no trace of original structure remaining. Microscopical examination showed it to be composed of pus corpuscles and rod shaped bacilli. Nothing abnormal was found in remaining organs.

AUTOPSY No. 136, CASE No. 1898.*—Male, aged 74, married, sawyer; nativity, United States; duration of insanity, seven months. Complications, cerebral apoplexy and acute endocarditis. Cause of death, cerebral apoplexy and acute endocarditis.

AUTOPSY. *Head*—Calvaria of average thickness but softened. Dura firmly adherent to skull cap and in middle fossa at base on right side presented a large area of bright red arterial injection. Pia thin. Along the lines of the vessels were streaks of opacity, and beneath pia, in middle fossa referred to, was an area of extravasated blood about one inch in diameter.



Brain—Weight 44 oz.; the tip of the right temporal lobe over the anterior extremities of the first and second convolutions were covered with freshly clotted blood. The cortical substance at this point was softened and eroded. The superior convolutions were flattened, firm and atrophied, with sulci gaping. In the centre of right corpus striatum was a brownish-red clot with a glistening fibrous investment. Around about this was an area of yellowish semi-fluid broken down brain tissue. In the right crus, at its emergence from the hemisphere, was a cicatrix of dark color about $1\frac{1}{2}$ inches long, extending outward and upward in the middle of the structure. Vessels at the base were atheromatous, very brittle, irregular in outline, with many fusiform dilatations.

Lungs—Normal.

Heart—Weight 10 oz. Left ventricle greatly hypertrophied, mitral valve thickened, nodulated and calcareous. Aortic calcareous, thickened and bound down. Tricuspid valve also showed areas of degeneration with deposit of lime salts.

* This case is remarkable in that it presented no symptoms corresponding to the lesions found post mortem.

Liver—Weight 36 oz. On section the lobules showed a dark centre with light periphery.

Spleen—Weight $2\frac{1}{2}$ oz., small and fibrous.

Kidneys—Weight of left $4\frac{1}{2}$ oz., of right 4 oz. In both the capsules were thick and adherent, structure firm and tough. Upon right were situated two cysts, each of which contained about 2 oz. of a reddish-brown fluid.

AUTOPSY No. 140, CASE No. 1288.—Female, aged 72, married, housewife; nativity, Germany; duration of insanity, twenty years. Complications, fatty degeneration and dilatation of heart. Cause of death, fatty degeneration and dilatation of heart.

AUTOPSY. *Head*—Skull presented no abnormalities. Dura very adherent to calvaria, venous sinuses filled with dark blood. Pia very opaque along longitudinal fissure. Cerebro-spinal fluid measured 8 fld. oz.

Brain—Weight $35\frac{1}{4}$ oz., small and firm with gaping sulci and atrophied convolutions. Section of brain revealed no gross lesions.

Lungs—Normal.

Heart—Weight 11 oz., muscle tissue pale, soft and friable, cavities dilated.

Liver—Weight 46 oz., soft, congested with various areas of yellowish pigmentation.

Spleen—Weight $7\frac{1}{2}$ oz., soft and friable.

Kidneys—Weight of left $5\frac{1}{2}$ oz., of right 5 oz., cortical and medullary portions normal in appearance.

AUTOPSY No. 141, CASE No. 1163.—Female, aged 55, single, domestic; nativity, United States; duration of insanity(?). Complication, enteritis. Cause of death, enteritis and debility.

AUTOPSY. *Head*—Skull thin but of average density. Dura thickened and unusually adherent along longitudinal fissure. Pia fibrous and thickened with circumscribed collections of serum over paracentral lobule of left side.

Brain—Weight 41 oz., convolutions presented no marked changes; on section the vessels were found to be thickened; no other lesions discoverable.

Lungs—Left adherent to parietal pleura at apex, right showed no adhesions and both were normal in appearance.

Heart—Weight 8 oz., muscle firm in texture and color normal, valves smooth and competent.

Liver—Weight 39 oz., fatty degeneration well marked, surface indented by ribs.

Kidneys—Weight of left $1\frac{1}{2}$ oz., of right $3\frac{1}{2}$ oz.; left very small, capsule adherent, cortex scarcely discernible, parenchyma entirely absent and in its place was a small amount of fat with much fibrous tissue; right dark in color with capsule adherent.

Intestines—Mucous membrane of both small and large intestines was much inflamed; this was especially noticeable about ileo-cæcal valve. Mesenteric glands enlarged, no ulcers present.

AUTOPSY No. 148, CASE No. 1696.—Female, aged 58, single, occupation, not any; nativity, United States; heredity, brother died of general paralysis; duration of insanity, twenty-seven years. Complications, chronic parenchymatous nephritis and arterial sclerosis. Cause of death, chronic parenchymatous nephritis.

AUTOPSY. *Head*—Skull cap of average density. Dura very adherent to calvaria and its vessels were distended with blood. Pia-arachnoid thickened and marked by numerous small opaque areas.

Brain—Weight $48\frac{1}{2}$ oz., cortex, beneath the pia, was covered with an exudate of a jelly-like consistence. This had not yet become organized, but it was marked by various opaque streaks. Convolutions of brain were atrophied; sulci gaping, brain tissue softened, vessels of centrum ovale and lenticular nuclei patulous and the perivascular spaces distinct. The vessels forming the circle of Willis were atheromatous in patches.

Lungs—Normal.

Heart—Weight $12\frac{1}{2}$ oz., soft, otherwise normal.

Spleen—Weight $6\frac{1}{4}$ oz., lobulated, the smaller lobule not being larger than a hazel-nut.

Kidneys—Weight of left $5\frac{3}{4}$ oz., of right $5\frac{3}{4}$ oz., capsules adherent, surfaces irregular, pale and cortical substance increased in thickness.

AUTOPSY No. 153, CASE No. 1341.—Female, aged 71, married, housewife; nativity, Canada; duration of insanity, twenty-seven years. Complications, interstitial nephritis and eczema of legs. Cause of death, interstitial nephritis.

AUTOPSY. *Head*—Skull thick, soft, and in some parts almost spongy. On removal of skull cap 7 oz. of bloody serum escaped. Dura clear, not thickened or adherent. Pia-arachnoid was infiltrated with serum and in some places opaque.

Brain—Weight $37\frac{1}{2}$ oz., no adhesions, convolutions atrophied, fissures shallow. On section, tissue was found to be softened, arteries markedly atheromatous; this was especially true of Sylvian artery, where it was given off from internal carotid.

Lungs—Right pleural cavity contained much bloody serum. The lung was generally free except at apex where there was a few adhesions. Lower lobes were deeply mottled bluish-black color in places, compressed and inelastic. Left lung was firmly adherent to chest wall, so that upon removal the lower lobe was torn. This pleural cavity also contained a small quantity of blood-stained serum, pleura firmly adherent to pericardium.

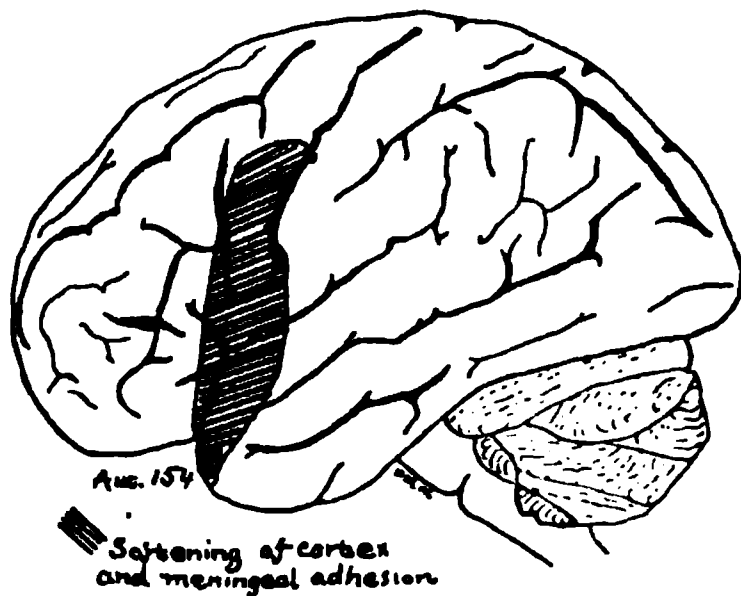
Heart—Weight $22\frac{1}{2}$ oz., pericardium thickened adherent to left

lung, anterior chest wall and to diaphragm. Pericardial cavity contained about 2 oz. of clear serum. Left ventricle very firm and much thickened, right ventricular wall thin, only a few lines of muscle tissue remaining. Valves not thickened or atheromatous.

AUTOPSY No. 154, CASE No. 1999.—Female, aged 65, single, domestic; nativity, United States; duration of insanity, two months(?). Complications, chronic endarteritis and cerebral apoplexy. Cause of death, cerebral apoplexy.

AUTOPSY. *Head*—Outer and inner tables thin, diploë thickened, dura adherent along superior longitudinal sinus and was torn on removal of calvaria.

Brain—Weight 48 oz., convolutions softened and flattened. The membranes stripped easily except along the lower two-thirds of the left anterior ascending convolution; here the pia was very adherent so that upon removal it tore the softened subjacent tissue. The softened area was white and extended across Sylvian fissure, involving the operculum and lower third of posterior ascending convolution.



The vessels at base showed many patches of atheromatous degeneration. The right vertebral artery for about one inch below the basilar was greatly dilated and its walls attenuated. The basilar presented many constrictions and dilatations. The left Sylvian artery was very fibrous, and in its second branch was found a fibrous clot.

Lungs—Lower lobe of right was firmly adherent to chest wall and diaphragm much softened and almost gangrenous. Posterior half of lower lobe of left was in a state of hypostatic congestion, airless and of leathery consistence.

Heart—Weight 19 oz., hypertrophied, muscle soft and friable, both ventricles contained clots. Lying across tricuspid orifice and covered by recent coagulum, was a thrombus which extended into the right pulmonary artery completely closing its lumen; this accounted for the condition of right lung spoken of above. Mitral and aortic valves thickened but competent.

Liver—Weight 42½ oz., firmly adherent to diaphragm, color deep blue-black externally, its surface furrowed by impression of ribs. Tissues much softened, washed surface showed mottling of passive hyperæmia. Gall bladder distended with a small quantity of bile and two large gall stones.

Spleen—Weight $5\frac{3}{4}$ oz., reddish-brown in color, capsule thickened and contracted, distorting surface of organ.

Kidneys—Weight of left $1\frac{1}{8}$ oz., of right 4 oz.; right was freely movable, capsule adherent, surface irregular. On section the division between the cortical and medullary portions was ill-defined. Left so small that it was with difficulty that it was found in the mass of perineal fat and connective tissue in which it was imbedded; its capsule was firmly adherent and contained an unrecognizable structure, mostly connective tissue surrounded by a band of reddish tissue about one line in thickness.

AUTOPSY No. 156, CASE No. 1687.—Female, aged 71, single, domestic; nativity, Ireland; duration of insanity, unknown. Complication, fatty degeneration of heart. Cause of death, shock from injury and fatty degeneration of heart.

AUTOPSY. *Head*—Not examined.

Heart—Weight 12 oz., left ventricle hypertrophied, heart fatty, mitral and aortic valves thickened; aorta showed various calcareous deposits in intima.

Lungs—Presented senile emphysema, pulmonary artery and abdominal aorta were atheromatous.

Kidneys—Capsules adherent, upon section they appeared granular.

Remaining organs presented no pathological changes.

AUTOPSY No. 159, CASE No. 1502.—Female, aged 57, married, occupation, not any; nativity, Germany; duration of insanity, sixteen months. Complication, chronic endarteritis. Cause of death, chronic endarteritis and organic disease of brain.

AUTOPSY. *Head*—Calvaria of average density and thickness Dura not adherent but its vessels were distended with blood. Vessels of pia and at base were also engorged with blood; their walls were smooth, regular in size and but slightly thickened.

Brain—Weight 43 oz., surfaces of the convolutions firm but somewhat flattened, tips of frontal lobes were deformed by contractures, being very narrow and irregular in outline. This atrophic condition extended backward to the motor region. On section the brain was found to be of fair consistence, its vessels distinct and the perivascular spaces prominent. This condition was especially noticeable in the lenticular nuclei and in the posterior half of left centrum ovale.

Lungs—Normal.

Heart—Weight $7\frac{3}{4}$ oz., muscle firm, valves smooth and competent.

Liver—Weight 28 oz.; capsule opaque and adherent to all adjacent structures, surface was mottled, being covered with light yellow areas surrounded by softened tissue of dark color.

Spleen—Weight 2 oz., small, otherwise no gross changes observed.

Kidneys—Weight of left $3\frac{1}{2}$ oz., of right $3\frac{1}{2}$ oz., contracted, capsules adherent; upon section they appeared red and the markings were indistinct.

AUTOPSY No. 160, CASE No. 919.—Female, aged 73, widow, housekeeper; nativity, United States; duration of insanity, unknown. Complication, dysentery. Cause of death, dysentery.

AUTOPSY. *Head*—Calvaria apparently normal. Dura firmly adherent to skull. Pia not adherent, its vessels were distended with blood.

Brain—Weight 36 oz., convolutions rounded and well developed, sulci deep. Arteries forming the circle of Willis were tortuous and brittle.

Lungs—Emphysematous, left apex adherent to chest wall, its lower lobe showed hypostatic congestion.

Heart—Weight $13\frac{1}{4}$ oz., muscle soft and flabby. Mitral valve thickened and contracted, vegetations abundant along free edge of cusps. In beginning of arch of aorta numerous atheromatous patches were seen.

Liver—Weight $40\frac{1}{2}$ oz., soft, greased knife when cut.

Spleen—Weight $3\frac{3}{4}$ oz., very soft, color darker than usual.

Kidneys—Weight of left $3\frac{3}{4}$ oz., of right 4 oz., capsules adherent, congested, cortices thinned.

Intestines—Mucous membrane of colon highly inflamed, at sigmoid flexure were numerous necrotic areas, and in a number of places ulcers were found.

AUTOPSY No. 166, CASE No. 1298.—Female, 71 years, widow, tailoress; nativity, Ireland; duration of insanity, three years. Complication, chronic hemorrhagic pachymeningitis. Cause of death, chronic hemorrhagic pachymeningitis.

AUTOPSY. *Head*—Bones of cranium very soft. Dura thickened but not adherent. Its inner surface on right side was covered by a layer of blood and broken down tissue. This material was of dark brown color and covered the frontal, temporal and anterior third of occipital lobes. The anterior and middle fossæ of skull showed brick-dust discoloration. Pia over left hemisphere was of reddish brown color and in region of temporal and lower parietal lobes it was thick and marked by streaks of opacity.

Brain—Weight $39\frac{1}{2}$ oz., softened so that when removed from cranial cavity and placed upon a plane surface it became much flattened. No local lesions were discovered.

Lungs—Normal.

Heart—Weight $7\frac{3}{4}$ oz., muscular walls firm, mitral valve thickened, with vegetations on free edges of cusps.

Liver—Weight 31 oz., friable, very dark brown in color. Gall bladder contained gall-stones.

Spleen—Weight $1\frac{3}{4}$ oz., small, shrunken and hard.

Kidneys—Weight of left $3\frac{1}{4}$ oz., of right $3\frac{1}{4}$ oz., capsules free, color pale, cortical and medullary portions showed no marked change.

AUTOPSY No. 173, CASE No. 1522.—Female, aged 54, married, housewife; nativity, Ireland; duration of insanity, twelve years. Complication, dysentery. Cause of death, dysentery.

AUTOPSY. *Head*—Calvaria thickened and somewhat softened; membranes pale and dura but slightly adherent.

Brain—Weight 43 oz., symmetrical in outline, and presented no gross changes.

Lungs—Slightly congested.

Heart—Weight 9 oz., cavities contained ante mortem clots, walls and valves normal.

Spleen—Weight $3\frac{1}{2}$ oz., of usual consistence.

Liver—Weight $42\frac{1}{2}$ oz., tissue softened and congested.

Kidneys—Weight of left $4\frac{1}{2}$ oz., of right 4 oz.; no gross lesions.

Intestines—Color of mucous membrane of colon very dark; in areas the mucous membrane was eroded. This condition was most marked in sigmoid flexure but also existed throughout colon in a lesser degree.

AUTOPSY No. 175, CASE No. 1922.—Female, aged 73, widow, housekeeper; nativity, Germany; duration of insanity, unknown. Complications, valvular disease of heart and dysentery. Cause of death, dysentery and valvular heart disease.

AUTOPSY. *Head*—Skull cap presented no abnormalities. Dura thickened and firmly adherent along superior longitudinal sinus anteriorly. Subarachnoid fluid increased. Pia not very clear but no adhesions existed.

Brain—Weight 43 oz., convolutions flattened, substance firm, perivascular spaces prominent, choroid plexuses cystic.

Lungs—Both apices presented small cicatrices and in the left calcareous deposits were found.

Heart—Weight $9\frac{1}{4}$ oz., muscle firm, left ventricle hypertrophied and its cavity diminished in size. The edges of the mitral valve contained vegetations, the chordæ tendinæ were contracted rendering the valve incompetent. Aortic valve was competent, but it was also thickened. Calcareous deposits were found in sinuses of Valsalva and near the orifices of the coronary arteries. In arch of aorta were found numerous areas of atheromatous degeneration. The pericardium upon its inner surface presented a softened gelatinous appearance; the pericardial cavity contained about one ounce of clear serum.

Liver—Weight $31\frac{1}{2}$ oz., surface irregular, the left lobe covered by a glistening layer of cicatricial tissue. On section the characteristic nutmeg appearance was seen.

Spleen—Weight $2\frac{1}{2}$ oz., very soft and dark in color.

Kidneys—Weight of left $4\frac{1}{4}$ oz., of right $4\frac{1}{8}$ oz., capsules adherent, surface contracted and irregular. The left contained several cysts which had lining membranes and contained urine. Cortices were thin, columns of Bertini pale and enlarged, pyramids small and compressed.

Intestines—Several coils of small intestines were adherent to stomach and liver. In cæcum were numerous erosions of mucous membrane, and below cæcum mucous membrane was very dark in color.

AUTOPSY No. 177, CASE No. 1731.—Female, aged 81, widow, occupation, not any; nativity, United States; duration of insanity, one and one-half years. Complications, chronic endarteritis, aneurism with rupture of heart. Cause of death, aneurism with rupture of heart.

AUTOPSY. *Head*—Skull of average thickness but somewhat softened; on its removal 6 oz. of bloody fluid escaped. The dura was thick, of leathery consistence and firmly adherent anteriorly near the great longitudinal sinus. Pia attenuated, easily torn and infiltrated with serum, while beneath it were numerous lakelets of clear, straw-colored serum.

Brain—Weight 40 oz., of average consistence. Its convolutions were attenuated and the sulci gaping. No erosions existed. Section of brain showed the arterioles distended and the perivascular spaces prominent. This condition was especially noticeable in basal ganglia. Arteries at base were atheromatous and their lumen diminished.

Lungs—Congested, œdematous and at base of right lung were a few adhesions.

Heart—Weight 9 oz., firm and contracted. On the anterior surface of left ventricle the rupture had occurred; the wall here was very thin, not being more than a few lines in thickness. The muscular tissue generally was very friable and easily broken and torn by the finger. The valves were thickened but the edges were free.

Liver—Weight $38\frac{1}{4}$ oz., capsule traversed by bands of cicatricial tissue. Tissue softened.

Spleen—Weight $4\frac{3}{4}$ oz., of normal consistence and color.

Kidneys—Weight of left $4\frac{1}{8}$ oz., of right $3\frac{1}{2}$ oz., both contracted.

AUTOPSY No. 179, CASE No 2252.—Male, aged 76, married, farmer; nativity, United States; heredity, two brothers insane; duration of insanity, three years. Complication, not any. Cause of death, debility of old age.

AUTOPSY. *Head*—Not examined.

Heart—Weight $9\frac{1}{2}$ oz., contracted and muscle firm; aortic valves at base were calcareous, though the process was not extensive. Valves competent.

Liver—Weight 35 oz., capsule thickened, organ contracted and very firm.

Spleen—Weight $2\frac{1}{2}$ oz., texture firm.

Kidneys—Weight of left $6\frac{1}{4}$ oz., of right $4\frac{1}{4}$ oz.; the left was intensely congested and upon its surface were two or three small cysts. The right was smaller, pale, and on its surface several small cysts were seen. The capsules of both were adherent.

AUTOPSY No. 183, CASE No. 1787.—Female, aged 53, married, housewife; nativity, Ireland; duration of insanity, four years. Complications, parenchymatous nephritis and chronic endarteritis. Cause of death, chronic parenchymatous nephritis. Contributing cause, chronic endarteritis

AUTOPSY. *Head*—Skull dense but of normal thickness; membranes apparently normal, cerebro-spinal fluid much increased.

Brain—Weight 34 oz., convolutions flattened and atrophied. Vessels of centrum ovale were congested and the surrounding brain tissue softened. Vessels at base were atheromatous.

Lungs—The two upper lobes of right were congested and at apex were tubercular nodules. The left was normal; there were no pleuritic adhesions.

Heart—Weight 7 oz. The visceral pericardium was discolored. The coronary vessels were thickened; the mitral valve was roughened and one cusp of aortic was fenestrated.

Liver—Weight 7 oz.; congested.

Kidneys—Weight of left $5\frac{3}{4}$ oz., of right $4\frac{1}{2}$ oz. Cortex of right increased, both were anæmic and capsules non-adherent; surfaces smooth.

Spleen—Weight $4\frac{1}{2}$ oz., it appeared normal but the capsule contained a calcareous plate.

AUTOPSY No. 184, CASE No. 2276.—Male, aged 37, single, hostler; nativity, United States; duration of insanity, three weeks (?). Complications, syphilis and meningitis. Cause of death, meningitis.

AUTOPSY. *Head*—Skull of average thickness but softened. Dura slightly adherent along longitudinal fissure but showed no essential change. Pia was reddened over vertex and beneath it the brain presented numerous hemorrhagic points on areas.

Brain—Structure firm. Over convex portion at base was a growth believed to be syphilitic. It involved the interpeduncular space and extended into the substance of the brain at the anterior perforated space. It was of grayish white appearance and of sufficient thickness to effectually conceal from view the structures lying beneath it.

Lungs—Both were congested. The posterior portion of left inferior lobe showed hypostatic pneumonia.

Heart—Muscle soft, both ventricles contained clotted blood.

Liver—Tissue soft and congested.

Kidneys and Spleen presented no gross pathological change.

AUTOPSY No. 187, CASE No. 2080.—Male, aged 66, widower, laborer; nativity, United States; duration of insanity, not ascertained. Complication, acute nephritis. Cause of death, acute nephritis.

AUTOPSY. *Head*—Skull cap presented no abnormalities. Membranes clear, of usual thickness and not adherent.

Brain—Weight 40 oz., no gross lesions found.

Lungs—Old pleuritic adhesions existed on both sides. Both were congested and the small bronchi and bronchioles contained bloody froth.

Heart—Weight $17\frac{3}{4}$ oz., the left ventricle contained a chicken-fat clot the centre of which was cheesy and granular. The walls were markedly hypertrophied. The aortic valve and ascending portion of arch of aorta were sclerosed; the cusps of the mitral valve were contracted and both valves were incompetent.

Liver—Weight 49 oz., cyanotic.

Spleen—Weight 8 oz., large and of dark color.

Kidneys—Weight of left 9 oz., of right $7\frac{1}{4}$ oz., capsules slightly adherent, color dark, cyanotic in appearance, section showed tissues swollen.

AUTOPSY No. 194, CASE No. 164.—Female, aged 59, married, housewife; nativity, Ireland; duration of insanity, twenty years. Complication, diabetes mellitus. Cause of death, diabetes mellitus.

AUTOPSY. *Head*—Calvaria softened, membranes clear, not adherent or thickened.

Brain—Weight 41 oz., convolutions irregular in outline and somewhat atrophied. The vessels in interior of brain were tough and thickened. No distinct lesions found.

Lungs—Showed recent hypostatic pneumonia.

Heart—Weight $10\frac{1}{2}$ oz., normal.

Liver—Weight 42 oz., capsule adherent to cortex and to diaphragm, color light, connective tissue increased. The gall bladder contained inspissated bile.

Kidneys—Weight of left $7\frac{1}{2}$ oz., of right 7 oz.; capsules not adherent, tissue firm and resistant; the interior appeared congested, connective tissue slightly increased.

Spleen—Weight $3\frac{1}{4}$ oz., no gross pathological lesions.

AUTOPSY No. 196, CASE No. 1444.—Male, aged 77, married, farmer; nativity, United States; duration of insanity, six years. Complication, cardiac dilatation. Cause of death, cardiac dilatation.

AUTOPSY. *Head*—Cranium well developed and of average thickness and density. Dura adherent to calvaria, especially along superior longitudinal fissure. Anterior to obelion and to the left of median line was a dural cyst of the size of a small hickory nut, which had caused erosion of the bone above and depression of brain

beneath. The membranes surrounding the cyst were thickened, in other parts they were normal.

Brain—Weight $41\frac{1}{2}$ oz., convolutions nearly normal though slightly atrophied. The vessels supplying the cerebrum had everywhere undergone thickening. At the base the deposit of calcareous matter, in the vessel walls, was so great as to almost obliterate their lumen. No focal lesions were present.

Lungs—Both were in a state of hypostatic pneumonia.

Heart—Weight $13\frac{1}{2}$ oz., the walls of the right auricle were markedly dilated and extremely thin. It contained a large ante mortem clot with post mortem clot deposited upon it. Both ventricular cavities were large and the mitral valve incompetent. No calcareous deposits were to be found.

Liver—Weight 50 oz., and of fairly normal consistence.

Kidneys—Weight of left 6 oz., of right $5\frac{1}{2}$ oz., capsules somewhat adherent, surfaces uneven, cortices slightly increased with a few small cysts on surfaces.

Spleen—Weight $2\frac{1}{2}$ oz., small but presented no local lesions.

AUTOPSY No. 197, CASE No 422.—Female, aged 68, single, domestic; nativity, United States; duration of insanity, fifty-five years; Complication, broncho-pneumonia. Cause of death, broncho-pneumonia.

AUTOPSY. *Head*—Not examined.

Lungs—Bases œdematous, congested in localized areas and from some of the lobules pus exuded.

Heart—Weight $10\frac{1}{2}$ oz., walls of average thickness but soft, this was especially true at the apex which was very friable and easily punctured by the finger. The left ventricle was relaxed and filled with post mortem clot. The right ventricle, right auricle and pulmonary artery contained an ante mortem clot. The valves showed no thickening or roughening by calcareous deposits.

Liver—Weight $49\frac{1}{2}$ oz., capsule very adherent to diaphragm, resistant to pressure, parenchyma unusually pale. With iodine test it gave a slight affirmative reaction.

Kidneys—Weight of left $3\frac{3}{4}$ oz., of right 3 oz., capsule adherent, tissue firm, connective tissue greatly increased.

Spleen—Weight 3 oz., small, light colored.

AUTOPSY No. 198, CASE No. 2272.—Male, aged 72, single, laborer; nativity, United States; heredity, one brother and sister insane; duration of insanity, three years (?). Complications, chronic interstitial nephritis and cardiac dilatation. Cause of death, chronic interstitial nephritis; contributing cause, cardiac dilatation.

AUTOPSY. *Head*—Skull symmetrical and of normal thickness and density.

Brain—Weight 51 oz., convolutions well developed, but the anterior lobes were somewhat softened. Base of brain was also soft, the hemispheres separating by their own weight, while the cerebellum broke easily beneath the fingers. Upon section, the gray matter was found to be diminished, the ventricles dilated and containing fluid: the corona radiata anæmic and softened, especially in the vicinity of the basal ganglia. The medulla was very pale, it being almost impossible to differentiate the white from the gray matter.

Lungs—Right emphysematous. Left congested at the base. At the apex of each an old tubercular cicatrix was found; complete healing had taken place and so prevented further invasion of the lung.

Heart—Weight 12 oz., aortic and mitral valves normal in appearance and competent. Both right and left ventricular walls were very thin and their cavities dilated. The right auricle contained an ante mortem clot.

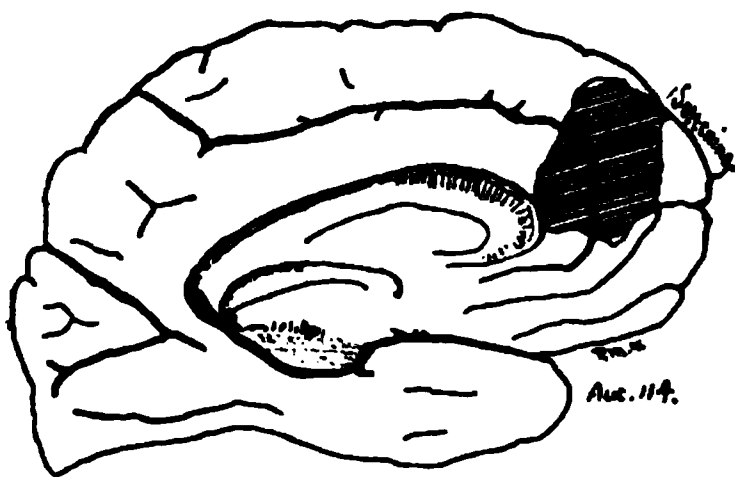
Liver—Weight 37½ oz., greatly congested and on section dark fluid blood oozed from its surface.

Spleen—Weight 1½ oz., small, shrunken and very friable.

EPILEPTIC DEMENTIA—TEN CASES.

AUTOPSY No. 114, CASE No. 1632.—Female, aged 43, single, housewife; nativity, United States; duration of insanity, three years. Complication, fractured clavicle. Cause of death, epilepsy.

AUTOPSY. *Head*—Skull of average thickness but very dense. Pia non-adherent, opaque and beneath it was a large quantity of serum; especially was this noticeable along the course of the vessels. The vessels of the brain substance were tough and could be drawn out to considerable length without breaking. At the base they showed a greater degree of degeneration, being thickened, tortuous and in many places containing calcareous deposits.



Brain—Weight 45 oz. On the under surface of anterior lobe of right side a large area of softening was found. Examination of the vessels revealed a thrombus in the anterior cerebral artery in front of the anterior communicating. The hippocampus major of this side

was apparently atrophied, being harder and smaller than on the left.

Lungs—Both were congested and both adherent to diaphragm. At the base of the left was a small cicatrix, in the centre of which was a calcareous deposit. Cicatrices were also found at base of right but no calcareous deposits.

Heart—Weight $12\frac{1}{2}$ oz., hypertrophied, valves competent and of normal color.

Aorta—Marked throughout arch by whitish patches, some of which were rough, but lime salts had not yet been deposited.

Liver and Spleen—Normal.

Kidneys—Weight of left $5\frac{3}{4}$ oz., of right 3 oz. The left was apparently normal, but the right was in an advanced stage of cystic degeneration, the parenchyma being entirely gone. Of the original structure the stroma alone remained.

AUTOPSY No. 119, CASE No. 1445.—Male, aged 30, single, laborer; nativity, Canada; duration of insanity, unknown. Complication, typhoid fever. Cause of death, typhoid fever and ulcerative endocarditis.

AUTOPSY. *Head*—Skull cap much thickened in frontal and occipital regions. Dura thickened and firmly adherent to skull throughout. The pia was thickened but translucent, stripping easily from cortex.

Brain—Weight 46 oz., convolutions normal in appearance, both white and gray matter were of firm consistency and of normal color. Vessels at base and throughout brain were somewhat enlarged.

Lungs—Both congested and abnormally pigmented. Right, posteriorly, was bound down from apex to base.

Heart—Weight $14\frac{1}{2}$ oz., dilated, color pale, aortic valves thickened but smooth. The bicuspid and tricuspid valves were thickened and ulcerated. Right and left ventricles contained organized blood clots.

Liver—Weight 63 oz., soft, friable, very dark in color, capsule adherent.

Spleen—Weight $9\frac{1}{2}$ oz., very soft.

Kidneys—Weight of left $7\frac{3}{4}$ oz., of right $5\frac{1}{4}$ oz., capsules of both adherent, cortices thickened, markings indistinct.

Small Intestines—Lymphatic glands in lower portion of ileum much enlarged, mucous membrane inflamed, thickened, Peyer's patches ulcerated.

AUTOPSY No. 120, CASE No. 1670.—Male, aged 64, married, laborer; nativity(?); duration of insanity, nine years. Complication, lobar pneumonia. Cause of death, lobar pneumonia.

AUTOPSY. *Head*—Calvaria thickened and softened. Dura of normal appearance and not unduly adherent. Pia thickened and its vessels much sclerosed.

Brain—Weight $53\frac{1}{2}$ oz., well formed, convolutions well rounded and in apposition; sulci narrow; anterior cerebral vessels very hard, stiff and pale in color.

Lungs—Lower lobe of right was in stage of red hepatization, middle and upper lobes crepitant. Both lobes of left lung were in stage of engorgement.

Heart—Weight $15\frac{1}{2}$ oz., dilated, walls thin, valves competent. Elevated syphilitic nodes were found at entrance of aorta.

Liver—Weight $57\frac{1}{2}$ oz., fatty degeneration well marked with smooth rounded borders. Biliary calculi of large size were found in gall bladder.

Remaining abdominal organs normal.

AUTOPSY No. 143, CASE No. 1786.—Female, aged 45; occupation, not any; nativity, United States; duration of insanity, twenty-five years. Complications, chronic diffuse nephritis and typhoid fever. Cause of death, typhoid fever and chronic diffuse nephritis.

AUTOPSY. *Head*—Not examined.

Lungs—Normal.

Heart—Weight $8\frac{1}{4}$ oz., muscle firm, base of aortic cusps roughened by calcareous deposits, pericardium contained 2 oz. of clear serum.

Liver—Weight 60 oz., soft, cavity of gall bladder filled by two large gall stones.

Spleen—Weight $5\frac{3}{4}$ oz., softened to jelly-like pulp which washed away when a stream of water was directed upon it.

Kidneys—Weight of left $7\frac{1}{4}$ oz., of right $6\frac{3}{4}$ oz., capsules of both were adherent, cortices and columns of Bertini were pale in color and the former were much increased in thickness.

Intestines—Lower foot of ileum presented small ulcers in different stages of development and surrounded by inflamed mucous membrane, cæcum was ulcerated and in some places there were areas of necrotic tissue almost gangrenous in character.

AUTOPSY No. 145, CASE No. 1296.—Female, aged 33, married, housewife; nativity, United States; heredity, an aunt had epilepsy; duration of insanity, two and one-half years. Complication, epilepsy. Cause of death, asphyxia

AUTOPSY. *Head*—Skull of average thickness and density. Dura congested but not thickened. Pia-arachnoid adherent to dura along longitudinal fissure; it was closely attached to brain but its removal caused no erosions.

Brain—Weight 43 oz., firm, convolutions well developed; on section no gross lesions were observed.

Lungs—Posteriorly, considerable hypostatic congestion.

Heart—Weight $11\frac{1}{2}$ oz., muscular tissue and valves normal in appearance.

Liver—Weight 54 oz., congested, color very dark, fatty degeneration present in a mild degree.

Spleen—Weight $7\frac{3}{4}$ oz., soft and congested.

Kidneys—Weight of left $4\frac{1}{4}$ oz., of right 5 oz., color dark, capsules moderately adherent, interstitial tissue increased.

AUTOPSY No. 146, CASE No. 1240.—Male, aged 44, single, laborer; nativity, United States; duration of insanity, fifteen years. Complications, acute pleurisy and epilepsy. Cause of death, acute pleurisy.

AUTOPSY. *Head*—Skull cap presented no abnormalities. Dura thin, pale and moderately adherent to calvaria. Pia thin, clear and not adherent to cortex. Cerebro-spinal fluid which escaped 7 oz.

Brain—Weight $39\frac{1}{4}$ oz., firm, convolutions atrophied, no local lesions found.

Lungs—Left normal, right bound down by adhesions. The pleural cavity of this side contained about two pints of bloody serum, pleura was roughened and injected; dull and covered with exuded fibrin.

Heart—Weight $11\frac{1}{4}$ oz., firm and contracted, valves competent.

Liver—Weight 50 oz., firm, pale and interstitial tissue noticeably increased.

Spleen—Weight $7\frac{1}{2}$ oz., very firm.

Kidneys—Weight of left $5\frac{1}{4}$ oz., of right 5 oz., capsules slightly adherent, surface pale, structure firm.

AUTOPSY No. 147, CASE No. 1257.—Female, aged 40, single; occupation, not any; nativity, United States; duration of insanity, twelve years (?). Complication, epilepsy. Cause of death, epilepsy.

AUTOPSY. *Head*—Skull of average density and thickness. Dura pale and adherent to calvaria along longitudinal sinus. Pia normal in appearance.

Brain—Weight $37\frac{1}{8}$ oz., firm, right hemisphere weighed $3\frac{7}{8}$ oz. more than left; this difference in weight was apparently due to atrophy of the frontal and parietal lobes of left side.

Lungs—Slightly congested.

Heart—Weight $9\frac{1}{2}$ oz., muscle firm, valves competent.

Liver—Weight $4\frac{1}{4}$ oz., congested.

Spleen—Weight $4\frac{1}{2}$ oz., congested.

Kidneys—Weight of left 4 oz., of right $4\frac{3}{4}$ oz., capsules adherent, interstitial tissue noticeably increased.

AUTOPSY No. 188, CASE No. 1261.—Female, aged 41, single, no occupation; nativity, United States; duration of insanity, sixteen years. Complication, chronic empyema. Cause of death, chronic empyema.

AUTOPSY. *Head*—Calvaria of usual thickness and density. Membranes clear and stripped readily.

Brain—Weight 47 oz., of soft consistence, convolutions about motor area small; cerebellum small. The vessels forming the circle of Willis were smaller than normal. Upon section no gross lesions were found.

Lungs—Pleuritic adhesions were present on both sides. At dependent portion of right pleural cavity was a circumscribed empyema.

Heart—Weight 8 oz., firm and contracted, aortic valve thickened, aortic intima was atheromatous.

Liver—Weight 46 oz., tough, very firm and of nutmeg appearance.

Spleen—Weight 6 oz., anæmic and very firm.

Kidneys—Weight of left $5\frac{1}{2}$ oz., of right $4\frac{1}{8}$ oz., color pale, capsules slightly adherent.

AUTOPSY No. 195, CASE No. 1804.—Male, aged 34, married; occupation, not any; nativity, United States: duration of insanity, seven years (?). Complication, erysipelas of head and face. Cause of death, erysipelas of head and face.

AUTOPSY. *Head*—Skull symmetrical and of average thickness and density. The cranial vessels were filled and the left lateral sinus contained a decolorized clot. Dura and pia adherent to each other at several points along longitudinal fissure. Beneath the pia were lakelets of serum.

Brain—Weight 45 oz., convolutions over convexity somewhat atrophied. On section the brain was of good consistence and presented no gross lesions.

Lungs—Both congested.

Heart—Weight $10\frac{1}{2}$ oz., muscle softened, mitral valve thickened but competent, aortic valve normal.

Liver—Weight $44\frac{1}{2}$ oz., slightly fatty, quite soft and friable.

Spleen—Weight 9 oz., enlarged and softened.

Kidneys—Weight of left $6\frac{1}{2}$ oz., of right $4\frac{3}{4}$ oz., aside from being congested no gross changes were noted.

AUTOPSY No. 200, CASE No. 1517.—Female, aged 47, single, domestic; nativity, United States; alleged cause, epilepsy; duration of insanity (?). Complications, epilepsy and typhoid fever. Cause of death, typhoid fever.

History—Patient has had epileptic seizures since 12 years of age, they have been frequent and quite severe. On entering the hospital she was quite demented, delusional and had hallucinations of sight. During the latter part of the first week of March patient took to her bed, complaining of weakness in her legs which were somewhat swollen. Temperature and pulse normal, appetite good March 14th she died.

Autopsy—Held ten hours after death showed skull to be of moderate density and thickness. Dura slightly adherent to calvaria on left side. Pia of normal thickness, clear and not adherent.

Brain—Weight $42\frac{1}{2}$ oz., symmetrical, somewhat softened, vessels at base normal. No local lesion existed.

Lungs—A few old pleuritic adhesions existed on both sides. The lower and posterior portions of each lung showed hypostatic congestion.

Heart—Weight 13 oz., muscle firm, the cavities contained no clots. The mitral and aortic valves were smooth and competent.

Liver—Weight 58 oz., fatty.

Kidneys—Weight of left 5 oz., of right 3 oz., capsules stripped readily, both kidneys were congested but presented no gross lesions.

Spleen—Weight 4 oz., friable.

Intestines—The small intestine was hyperæmic, the mucous membrane of ileum was covered with slimy mucus of a greenish tinge; when this was washed away several small round ulcers were seen.

ACUTE MELANCHOLIA—TWELVE CASES.

AUTOPSY No. 106, CASE No. 1418.—Female, aged 27, married, domestic; nativity, United States; duration of insanity seven years, six months. Complication, dysentery. Cause of death, dysentery.

AUTOPSY. *Head*—Calvaria of average density and thickness. Membranes of normal appearance. Dura not unduly adherent, pia clear and easily removed.

Brain—Weight $43\frac{1}{2}$ oz., normal in appearance, convolutions well developed and presenting no structural changes.

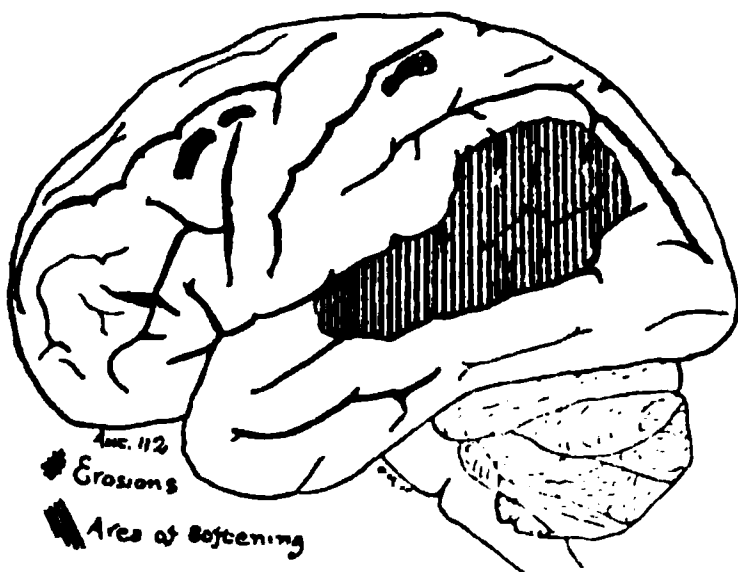
Lungs—Latent tubercular nodules were found at the apices, as also were cavities which contained pus and broken down tissue.

Heart—Weight 7 oz., walls firm, valves competent.

Liver, Spleen and Kidneys—Normal.

Stomach and Small Intestines were congested. Below the ileo-cæcal valve, and especially at the sigmoid flexure the intestinal wall was much thickened. The serous coat was congested and converted into a mottled dark red area of ulceration, with little fibrous exudate upon its surface.

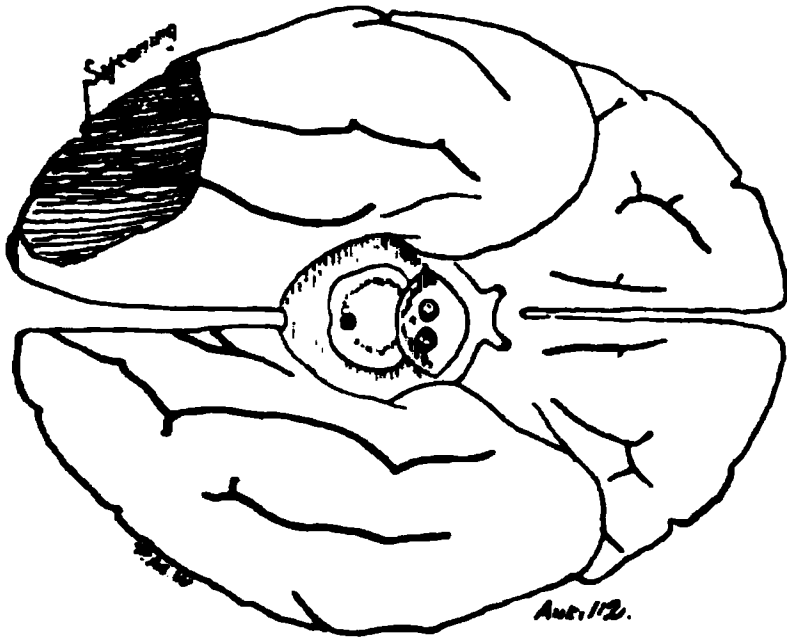
AUTOPSY No. 112, CASE No. 1735.—Female, aged 68, widow, saloon-keeper; nativity, England; duration of insanity, ten months. Complication, chronic diffuse nephritis. Cause of death, chronic diffuse nephritis.



AUTOPSY. *Head*—Skull cap dense, dura firmly adherent to the skull and somewhat thickened. The pia was thickened, but not adherent to the cortex, except in three small places on the left ascending and middle frontal convolutions. These adhesions were red and seemed due to recent hemorrhage.

Brain—Weight $46\frac{1}{2}$ oz. On the left side there was a large area of cystic softening, involving the superior parietal convolution and ex-

tending upward to the occipital region. On the right side there was also an area of cystic degeneration, involving the inferior surface of the occipital lobe and covering an area of about one square inch.



The arteries throughout the body were atheromatous, this being especially well shown in those forming the circle of Willis, which were found to be quite brittle and containing numerous hard plates. The smaller arteries in the gray and white matter of the brain were hard and wiry. The ventricles were dilated and contained clear fluid. Numerous cysts of

the choroid flexures were also found.

Lungs—Both lungs were firmly adherent to the upper portion of chest wall, anteriorly and posteriorly, but no intrinsic lesions were discovered.

Heart—Weight $11\frac{1}{4}$ oz., firm, hypertrophied concentrically, the wall of the left ventricle being $1\frac{1}{8}$ inches thick. The valves were somewhat thickened, but not roughened, and were competent. The first portion of the aortic arch was roughened by atheromatous deposit.

Liver—Weight 40 oz., very soft and pulpy, structure mottled, nutmeg in character.

Spleen—Weight 4 oz., soft, pultaceous.

Kidneys—Weight of left $3\frac{3}{4}$ oz., of right $3\frac{1}{2}$ oz. Both were pale with adherent capsules. The surface of the left was corrugated and a cut section revealed indistinct markings with pronounced pallor.

AUTOPSY No. 129, CASE No. 1838.—Female, aged 51, single, domestic; nativity, America; heredity, relatives all dead, one uncle on paternal side insane; duration of insanity, four months. Complication, carcinoma of right breast. Cause of death, carcinoma and softening of brain.

AUTOPSY. *Head*—Skull thick but softened in areas, markedly so over right parietal bone. Dura at base was rusty colored and mottled throughout. Upon removal of brain about 10 oz. of serum and blood escaped. Pia was thin, pale and anæmic. On the cortex beneath the pia could be seen small collections of serum. Pia stripped from brain with difficulty but caused no erosions; its vessels were much thickened at the various points of bifurcation.

Brain—Weight $41\frac{1}{2}$ oz., compact and hard to the touch. On section the vessels appeared prominent, especially the ganglionic

vessels which were atheromatous and felt gritty under the knife. The convolutions were small and thin, sulci shallow and gaping. The upper surfaces of the optic thalami were roughened and corrugated. Choroid plexuses cystic. Pituitary body hypertrophied. In the substance of the medulla on the left side, just above the olivary body, a narrow focus of softening was discovered.

Lungs—Pleuritic adhesions numerous.

Heart—Weight 7 oz., cavities diminished, ventricular walls thickened, valves competent.

Liver—Weight 72 oz., large, tough, surface mottled, right lobe extended downward nearly to crest of ileum. Its edges were rounded and in places contracted by bands of cicatricial tissue.

Spleen—Weight 9 oz., firm, surface dotted with several small areas of diseased tissue.

Kidneys—Weight of left $6\frac{1}{2}$ oz., of right $6\frac{1}{2}$ oz.; capsule of right free, of left very adherent, taking away portions of the cortex upon removal. In both the structure was firm and pale with indistinct markings.

AUTOPSY No. 139, CASE No. 1042.—Female, aged 39, married, washerwoman; nativity, United States; heredity, one sister insane; duration of insanity, two years. Complications, acute meningitis and broncho-pneumonia. Cause of death, acute meningitis and broncho-pneumonia.

AUTOPSY. *Head*—Skull thickened, softened and diploë vascular. Dura very vascular, not adherent. Pia appeared water-logged, œdematous, engorged with blood; not adherent to cortex.

Brain—Weight 39 oz., convolutions well developed, brain substance softened and its vessels congested.

Lungs—Upper lobes œdematous, lower half of lower lobes were very dark and purplish; upon section consolidated areas were found and the bronchioles and small bronchi contained creamy mucus.

Heart—Weight $8\frac{1}{4}$ oz., soft and flabby.

Liver—Weight 30 oz., soft.

Spleen—Weight $4\frac{3}{4}$ oz., markedly pultaceous.

Kidneys—Weight of left $4\frac{1}{2}$ oz., of right $4\frac{3}{4}$ oz., cortical portions pale and swollen.

AUTOPSY No. 151, CASE No. 1905.—Female, aged 49, married, housewife; nativity, United States; duration of insanity, twenty-one months. Complication, chronic cerebral meningitis. Cause of death, chronic cerebral meningitis.

AUTOPSY. *Head*—Skull cap thick and very dense. Dura not adherent; pia-arachnoid thick, injected, opaque over vertex with glistening white streaks marking the line of the vessels; in many portions the membrane appeared "water-logged." Pia was adherent to dura

in region of Pacchionian bodies and in these adhesions were small calcareous deposits.

Brain—Weight $39\frac{1}{2}$ oz., convolutions attenuated, sulci shallow and gaping, cerebral substance softened. On section, the vessels of brain were found congested and remained patulous.

Lungs—Normal.

Heart—Weight $6\frac{1}{4}$ oz., small, compact, muscle of good color, valves clear and competent.

Liver—Weight 34 oz., color deep brown, texture firm.

Spleen—Weight $1\frac{5}{8}$ oz., very small, outline regular, its consistence apparently not increased.

Kidneys—Weight of left $3\frac{1}{2}$ oz., of right, 3 oz., both small, firm and cloudy, markings indistinct, capsules slightly adherent.

AUTOPSY No. 163, CASE No. 2181.—Male, aged 57, married, farmer, nativity, Ireland; duration of insanity, five weeks. Complications, paralysis agitans and acute nephritis. Cause of death, acute nephritis.

AUTOPSY. *Head*—Skull of normal thickness and density; dura not unduly adherent to calvaria; in falx cerebri was a large calcareous plate.

Brain—Weight $53\frac{1}{4}$ oz., unusually large and well developed. No gross lesions were discovered. Membranes clear, not adherent or thickened.

Heart—Weight 18 oz., large, fatty, muscle of good color and consistence, valves competent.

Liver—Weight 52 oz., fatty degeneration well marked.

Kidneys—Weight of left $6\frac{3}{4}$ oz., of right 8 oz., both swollen, red and acutely inflamed; numerous small cysts were scattered over the surface of each. Remaining organs normal.

AUTOPSY No. 167, CASE No. 1115.—Female, aged 37, single, domestic; nativity, Ireland; duration of insanity, two years. Complication, dysentery. Cause of death, cardiac paralysis and dysentery.

AUTOPSY. *Head*—Calvaria presented no pathological conditions. Membranes clear and not unduly adherent, vessels of membranes collapsed.

Brain—Weight 50 oz., quite soft and section revealed numerous small punctate points.

Lungs—Apices were the seat of old tubercular processes. Remaining portions of lungs were crepitant and apparently normal. No adhesions existed.

Heart—Weight $8\frac{1}{4}$ oz., relaxed and completely filled with blood.

Kidneys—Weight of left $5\frac{1}{2}$ oz., of right $5\frac{1}{4}$ oz., capsules adherent, connective tissue increased.

Spleen—Weight $3\frac{3}{4}$ oz., pultaceous.

Intestines—Mucous membrane of transverse colon very dark in color, almost gangrenous. In many places the membrane had entirely disappeared.

AUTOPSY No. 168, CASE No. 1223.—Female, aged 40, married, housewife; nativity, Ireland; duration of insanity, two years. Complication, phthisis pulmonalis. Cause of death, phthisis pulmonalis.

AUTOPSY. *Head*—Skull cap of normal thickness. Dura and pia were clear, pale and not unduly adherent.

Brain—Weight $43\frac{1}{2}$ oz., softened throughout so that the corpus callosum was ruptured by weight of the hemisphere when brain was removed. No gross lesions were found.

Lungs—Did not collapse on opening thorax. Left lung posteriorly was bound to chest wall by numerous strong adhesions. At its apex was a cavity the size of a hazel-nut, irregular in outline and filled with a cheesy mass of broken down tissue. The remaining portion of lung was of the consistence of liver and studded with tubercles and many areas of caseous degeneration. Right lung was crepitant, but upon its surface numerous tubercular foci could be seen.

Heart—Weight $7\frac{3}{4}$ oz., muscle weak and flabby.

Kidneys—Weight of left $3\frac{3}{4}$ oz., of right $3\frac{1}{2}$ oz., capsules not adherent, color dark red.

Liver—Weight $31\frac{1}{2}$ oz., tissue very friable.

Spleen—Weight 3 oz., very firm.

AUTOPSY No. 172, CASE No. 1331.—Female, aged 41, widow, housewife; nativity, Ireland; duration of insanity, twenty months. Complications, syphilis and dysentery. Cause of death, dysentery.

AUTOPSY. *Head*—Calvaria thickened, membranes normal, vessels tough but not calcareous.

Brain—Weight $45\frac{3}{4}$ oz., firm, symmetrical.

Lungs—Pleuritic adhesions at apices and at base of right posteriorly.

Heart—Weight $8\frac{3}{4}$ oz., valves competent, but at base of mitral valve were a number of calcareous deposits.

Kidneys—Weight of left $5\frac{1}{2}$ oz., of right $5\frac{1}{2}$ oz., capsules adherent in places. No other gross changes noticed.

Intestines—The large intestinal wall was thickened and inflamed. The mucous membrane was very dark, almost gangrenous in color. There were numerous large, superficial ulcers with irregular borders. The portion of the colon more particularly involved was just above and throughout the sigmoid flexure.

AUTOPSY No. 174, CASE No. 2152.—Female, aged 27, single, domestic; nativity, Canada; heredity, mother insane; duration of insanity, four months. Complication, exophthalmic goitre. Cause of death, cerebral thrombosis.

AUTOPSY. *Head*—Skull thick and asymmetrical. Dura not adherent, but in superior longitudinal sinus was found a firm, cream-colored thrombus about four inches in length and one-eighth of an inch in thickness. Numerous prolongations extended from the clot into the veins communicating with the sinus at this point. Pia was "water-logged," veins over vertex were engorged.

Brain—Weight 48 oz., substance much softened so that the hemispheres separated by their own weight when brain was placed on a plane surface. No focal lesions found.

Lungs—Collapsed; at base of right were found numerous pleuritic adhesions.

Heart—Weight $10\frac{1}{4}$ oz., muscle soft. Walls of right ventricle extremely thin and its cavity contained an organized clot. Left ventricle contained chicken-fat clot, valves competent.

Liver—Weight $35\frac{1}{2}$ oz., softened.

Spleen—Weight $4\frac{1}{4}$ oz., pultaceous.

Kidneys—Weight of left $4\frac{1}{2}$ oz., of right $4\frac{3}{4}$ oz., capsules not adherent, surfaces lobulated; no indications of pathological change.

AUTOPSY No. 190, CASE No. 1908.—Male, aged 56, married, farmer; nativity, United States; heredity, mother insane; duration of insanity, ten months. Complications, cardiac dilatation and carcinoma of liver. Cause of death, carcinoma of liver. Contributing cause, cardiac dilatation.

AUTOPSY. *Head*—Skull unusually thick but of normal density. Dura firmly adherent along longitudinal fissure and in certain portions to subjacent membranes. Pia was thickened and somewhat opaque.

Brain—Weight 50 oz., surface pale, granular with circumscribed collections of serum, the lateral ventricles were distended with serum, quantity, about 6 oz.; the blood vessels showed no pathological changes.

Lungs—On right side were a few pleuritic adhesions.

Heart—Weight 13 oz., muscle and valves normal.

Liver—Weight $117\frac{1}{4}$ oz., of enormous size and contained in its right lobe a carcinomatous tumor $4\frac{1}{2}$ inches in diameter.

Kidneys—Weight of left 8 oz., of right $7\frac{1}{2}$ oz., capsules not adherent, they were very firm and dark in color; on the surface of each were a number of small cysts.

Spleen—Weight $8\frac{3}{4}$ oz., surface of granular appearance and feel, color very dark.

AUTOPSY No. 191, CASE No. 1681.—Male, aged 64, widower; occupation, not any at present; nativity, United States; duration of insanity, one year eight months. Complication, phthisis. Cause of death, phthisis.

AUTOPSY. *Head*—Skull large and of average thickness and density. The membranes presented no abnormalities, the quantity of serum small; the vessels at the base were thickened.

Brain—Weight $53\frac{1}{2}$ oz., large and symmetrical, no gross lesions.

Lungs—Left lower lobe at its upper portion, contained a large tubercular cavity, surrounding this, the tissues were so infiltrated with tubercular nodules that little active lung tissue remained. At apex of right lung were tubercular nodules which had become encapsulated.

Heart—Weight $7\frac{3}{4}$ oz., muscle firm and no valvular lesions existed.

Liver—Weight 38 oz., somewhat softened.

Kidneys—Weight of left $5\frac{1}{2}$ oz., of right 4 oz., in both the capsules were somewhat adherent; the cortices thin and pale.

Spleen—Weight $4\frac{1}{2}$ oz., appeared normal.

CHRONIC MELANCHOLIA—FIVE CASES.

AUTOPSY No. 157, CASE No. 1391.—Male, aged 34, single, waiter; nativity, United States; duration of insanity, four years. Complications, syphilis and chronic pyæmia. Cause of death, syphilis and chronic pyæmia.

AUTOPSY. *Head*—Skull thickened and softened. The membranes presented no gross changes.

Brain—Weight $51\frac{1}{2}$ oz., outline regular, of firm consistence; olfactory tracts attenuated and olfactory bulbs small and flattened. In floor of lateral ventricle of left side was a large area of softening which extended backward as far as the tip of occipital lobe.

Chest—Externally small abscesses were found in right costal region, behind right shoulder, right hip and right ankle.

Lungs—Color pale, posterior part of lower portion of upper lobe on left side was indurated and adherent to parietes. Right pleural cavity contained creamy pus which had found its way thither from the costal abscess mentioned above.

Heart—Weight $8\frac{3}{4}$ oz., muscle flabby and covered with a considerable quantity of fat. Valves competent. Aorta showed numerous irregular patches white in color but not calcareous.

Liver—Weight $48\frac{1}{2}$ oz., outer border of right lobe contained a gumma the size of an orange.

Kidneys and Spleen presented no gross changes.

AUTOPSY No. 164, CASE No. 139.—Male, aged 67, widower, laborer; nativity, Ireland; duration of insanity, not known. Complication, dysentery. Cause of death, dysentery.

AUTOPSY. *Head*—Calvaria of average thickness and density. Dura presented no gross lesions. Pia thickened, vessels marked by

streaks of opacity; not adherent to cortex. Vessels at base were fibrous, and the posterior communicating very small.

Brain—Weight $46\frac{1}{2}$ oz., rather soft. Aside from this no pathological changes were observed.

Heart—Weight $12\frac{1}{2}$ oz.; both ventricles contained clotted blood, mitral valve thickened and bound down by shortened chordæ-tendinæ. In the visceral layer of pericardium was found a calcareous plate; several were also found in the arch of aorta above the base of the valves.

Lungs—Emphysematous.

Liver—Weight 48 oz., fatty.

Small Intestines were congested.

The *Large Intestine* was acutely inflamed. In sigmoid flexure the mucous membrane was denuded in many places and sloughing of the deeper tissues had taken place. In these areas the color was greenish black.

Kidneys—Weight of left 5 oz., of right $4\frac{3}{4}$ oz., very firm and cut with difficulty. On the right was a large cyst which covered one-quarter of its surface.

Spleen—Weight $2\frac{1}{2}$ oz., unusually firm.

AUTOPSY No. 170, CASE No. 1869.—Male, aged 55, married, contractor and builder; nativity, United States; heredity, father and uncle insane; duration of insanity, nine and one-half months. Complications, chronic endocarditis and endarteritis. Cause of death, valvular heart disease with dilatation.

AUTOPSY. *Head*—Skull irregularly thickened; dura not unusually adherent to calvaria. Pia thickened but not adherent to cortex.

Brain—Weight $47\frac{3}{4}$ oz., gray matter somewhat softened but no local lesions were found.

Lungs—Pleuritic adhesions existed at left apex; apex of right lung contained several hard nodular bodies; edges of lobes were emphysematous.

Heart—Weight $26\frac{1}{4}$ oz., extremely large, ventricular walls hypertrophied, cavities dilated, aortic valve thickened, surface rough, incompetent. Aortic intima roughened and exhibiting numerous atheromatous patches. Pericardial cavity contained considerable fluid.

Liver—Weight $54\frac{1}{4}$ oz., surface nodular, cut section presented nutmeg appearance.

Kidneys—Weight of left $5\frac{1}{4}$ oz., of right 6 oz., capsules adherent, causing erosions when removed; cortices not noticeably thinned.

AUTOPSY No. 192, CASE No. 363.—Male, aged 29, single, carpenter; nativity, United States; duration of insanity (present attack), one year. Complication, cirrhosis of liver. Cause of death, cirrhosis of liver.

AUTOPSY. *Head*—Skull normal, membranes smooth, clear and not adherent.

Brain—Weight 47 oz., convolutions moderately atrophied, sulci shallow and gaping. Section of brain revealed no gross pathological changes.

Lungs—Both somewhat oedematous and both pleural cavities contained a considerable quantity of fluid.

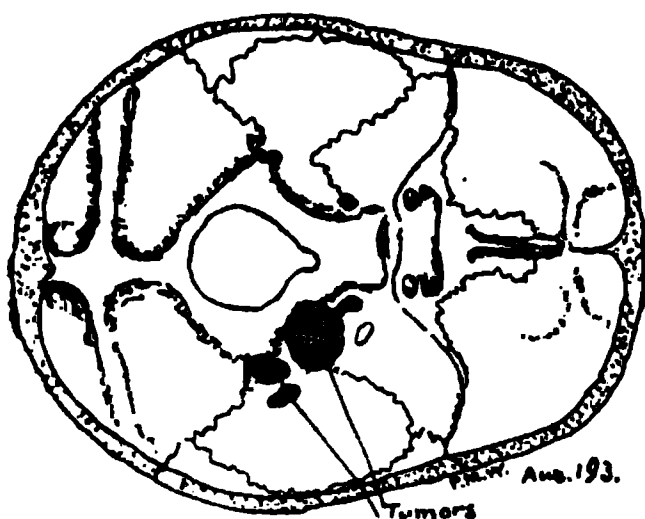
Heart—Weight 18½ oz., walls of normal color and thickness, valves normal.

Liver—Weight 51½ oz., yellowish in color, very firm, capsule moderately adherent to cortex and to diaphragm. On section it appeared hyperæmic with numerous streaks of connective tissue appearing as light colored areas interspersed between the darker ones.

Kidneys—Weight of left 5½ oz., of right 6¼ oz., both dark in color; texture firm.

Spleen—Weight 7½ oz., congested and softened.

AUTOPSY No. 193, CASE No. 483.—Female, aged 48, married, housewife; nativity, United States; heredity, uncle insane; duration of insanity, five and one-half years. Complication, osteo-sarcoma. Cause of death, osteo-sarcoma.



AUTOPSY. *Head*—On the right side of face and neck was a tumor of irregular, nodular outline and of purplish color. It was firmly attached to the inferior maxillary just below and posterior to external auditory meatus. The tumor, over its convexity, had ulcerated and presented a ragged, angry appearance. It had grown in all directions, crowding the ear upward, and the

eye far forward, below it extended to the manubrium and clavicle, posteriorly it extended to posterior portion of right ear where several small firm nodules appeared. It was firmly attached to mastoid portion of temporal bone. Inward the tumor had grown through the left temporal bone, partially filling the middle fossa of base of skull with cauliflower-like masses ranging in size from a hazel-nut to that of a walnut. The bones at this point were of the consistence of gristle, easily cut by the knife, and section was of a dirty gray color.

Brain—Weight 43 oz., the left temporo-sphenoidal lobe was compressed and softened. The convolutions generally were atrophied and the sulci gaping.

Lungs—A few pleuritic adhesions were found on each side and in the apices of each were found several yellowish nodules in a state of cheesy degeneration.

Heart—Weight 9 oz., color pale, valves normal.

Liver—Weight 35 oz.

Spleen—Weight 3 oz., aside from its size nothing abnormal was discovered.

Kidneys—Weight of left 4 oz., of right $3\frac{3}{4}$ oz., capsules adherent, color pale, cortices thin, fibrous tissue somewhat increased.

ACUTE MANIA—THREE CASES.

AUTOPSY No. 149, CASE No. 1822.—Female, aged 30, single, housekeeper; nativity, United States; duration of insanity (present attack), seven and one-half months. Complication, typhoid fever. Cause of death, typhoid fever.

AUTOPSY. *Intestines* only were examined, mucous membrane of jejunum injected and discolored. In ileum it was thickened, softened and covered with a slimy discharge, beneath which were found several rounded punched out ulcers; the last two inches of ileum forming one large slough.

AUTOPSY No. 150, CASE No. 1744.—Female, aged 22, single, domestic; nativity, United States; heredity, paternal aunt insane; duration of insanity, two years and four months. Complication, acute pulmonary tuberculosis. Cause of death, acute pulmonary tuberculosis.

AUTOPSY. *Head*—Calvaria of normal thickness and density with the dura firmly adherent. Pia not thickened or adherent, but its vessels were injected and the venous sinuses filled with dark blood.

Brain—Weight $52\frac{1}{2}$ oz., firm, surfaces of convolutions flattened, no other lesions were discovered

Lungs—Left slightly adherent at apex, its upper lobe consolidated in its upper portion, with hard nodular bodies on the pleural surface. Right was almost entirely destroyed, the upper lobe being a mere shell enclosing a cavity several inches in diameter, across which ran bands of connective tissue and a few small blood vessels. At its extreme apex was a smaller cavity, containing a white, creamy puruloid material. Middle and lower lobes were consolidated and the whole lung was so adherent to the chest wall that it had to be removed with a knife.

Heart—Weight 5 oz.; muscle softened. Left ventricle contained an organized thrombus, with red clot adhering to muscular pillars.

Liver—Weight $28\frac{1}{2}$ oz., with the exception of its extremely small size nothing abnormal was seen.

Spleen—Weight 4 oz., firm, connective tissue increased.

Kidneys—Weight of left 5 oz., of right 5 oz., capsule not adherent, cortices of yellowish white glistening color, pyramids usually red, some light colored. The whole presented an amyloid appearance.

AUTOPSY No. 155, CASE No. 1863.—Female, aged 41, married, housewife; nativity, Ireland; duration of insanity, eight months. Complications, acute catarrhal enteritis and cerebral thrombosis. Cause of death, same.

AUTOPSY. *Head*—Skull cap thick and dense; dura adherent over anterior portion of longitudinal fissure and anterior lobes were agglutinated. Between the anterior lobes in superior longitudinal fissure was found a firmly organized clot, pale yellow in color, about two inches in length and one-quarter inch thick, imbedded in and between the meshes of the dura. The occipital and lateral sinuses were filled with freshly coagulated blood. Pia was not thickened or adherent to cortex, but its vessels, over vertex, were distended with blood.

Brain—Weight 41 oz., unusually firm, aside from this no lesions were found.

Lungs—Distended, did not collapse on opening the chest.

Heart—Weight $7\frac{1}{2}$ oz., structure firm, valves delicate and free from adhesions or deposits.

Liver—Weight 42 oz., softened, color pale, cut section greasy.

Spleen—Weight $2\frac{3}{4}$ oz., no pathological change noticed.

Kidneys—Weight of left $4\frac{1}{2}$ oz., of right $2\frac{3}{4}$ oz., capsules slightly adherent, structure very firm, connective tissue increased, pyramids pale, cortices thickened.

Small Intestine—Mucous membrane reddened, lower eighteen inches of ileum greenish black and gangrenous in appearance. No ulcerations were discovered.

CHRONIC MANIA—TEN CASES.

AUTOPSY No. 111, CASE No. 1233.—Male, aged 31, single, bartender; nativity, Ireland; duration of insanity, unknown. Complication, acute nephritis. Cause of death, acute nephritis.

Patient's History previous to entering hospital, meagre and unsatisfactory. Since admission has been dull and demented, presenting no special symptoms till twenty-four hours before death, when he suddenly became unconscious, had several convulsive seizures and between this time and his death had over one hundred general convulsions.

AUTOPSY. *Head*—Calvaria thickened, veins of dura and pia filled with blood, pia not adherent, but opaque along superior longitudinal fissure. Upon incising the membrane a large quantity of bloody serum escaped.

Brain—Weight 53 oz., gray matter pale, convolutions well developed, sulci deep.

Lungs—Normal.

Heart—Weight 13 oz., hypertrophied, valves smooth, competent.

Liver and Spleen—Normal.

Kidneys—Left $6\frac{1}{4}$ oz., right $5\frac{1}{2}$ oz., upon section were cloudy; microscopically the uriniferous tubules and glomeruli were found to be filled with small, round cells, leucocytes and exfoliated epithelium. Examination of the urine showed blood and a large quantity of albumin.

AUTOPSY No. 113, CASE No. 815.—Male, aged 34, single, laborer; nativity, United States; duration of insanity, three years. Complication, dysentery. Cause of death, dysentery.

AUTOPSY. *Head*—Skull was quite dense and of irregular thickness. Dura thick, firm and adherent to skull. The pia was much thickened, especially over the vertex on either side of the longitudinal fissure where it was quite opaque and milky in appearance. The blood vessels of the pia were very much distended.

Brain—Weight $44\frac{1}{4}$ oz., the convolutions were somewhat atrophied but no other lesions of brain were discovered.

Lungs—Left collapsed and firmly adherent throughout. Right was bound to chest by several bands of connective tissue, otherwise normal.

Heart—Weight 9 oz., muscle and valves normal.

Aorta—Small, with atheromatous deposits at its beginning.

Liver—Weight 42 oz., congested, friable and firmly adherent to diaphragm.

Spleen—Weight $4\frac{1}{2}$ oz., quite friable and very dark in color.

Kidneys—Weight of left $5\frac{1}{2}$ oz., of right $4\frac{7}{8}$ oz. In both the capsules were somewhat adherent, cortices thickened and the markings indistinct.

Small Intestine—Normal.

Large Intestine—In the descending colon and sigmoid flexure there was marked thickening of entire wall. The mucous membrane was thickened, dark red in color and in places ulcerated.

AUTOPSY No. 116, CASE No. 1455.—Male, aged 49, single, laborer; nativity, United States; duration of insanity, eight years; heredity, mother insane. Complication, cerebral hemorrhage. Cause of death, cerebral hemorrhage.

AUTOPSY. *Head*—Calvaria of average density and thickness. The dura was somewhat thickened and on the left side there was an extravasation of blood beneath the pia. The hemorrhage, however, was slight and only resulted in staining the tissues.

Brain—Weight 53 oz. On the right side, at the base, near the origin of the fissure of Sylvius, a clot was found extending upward and filling the lateral ventricle of that side. There was considerable destruction of tissue along the inner border of the ventricle and the corpus striatum. The vessels at the base of the brain were thickened and calcareous.

Lungs—Normal.

Heart—Weight 13 oz.; enlarged but presented no pathological lesions.

Liver—Weight 39½ oz., soft, slight degree of fatty degeneration.

Kidneys—Weight of left 4½ oz., of right 4½ oz., both dark in color but otherwise normal.

Spleen—Weight 3¼ oz. Appearance, normal.

AUTOPSY No. 128, CASE No. 1364.—Male, aged 29, single, laborer; nativity, United States; heredity, paternal grandmother, uncle, brother and sister insane; duration of insanity, seven years eleven months. Complication, arterio-sclerosis Cause of death, arterio-sclerosis and cellulitis.

AUTOPSY. *Head*—Calvaria thin and dense. Dura thickened and closely adherent to skull cap along longitudinal fissure, requiring to be cut to avoid tearing brain. Pia was considerably thickened, opaque along longitudinal fissure and beneath it were lakelets of serum. The vessels of the pia were large and filled with blood. Vessels at base were thickened but not atheromatous.

Brain—Weight 54½ oz., soft but otherwise normal in appearance.

Lungs—Normal.

Heart—Weight 12 oz., pale, firm, endocardium intensely reddened.

Liver—Weight 79 oz., congested, soft and friable. Remaining organs presented no pathological changes.

AUTOPSY No. 134, CASE No. 1823.—Male, aged 48, married, merchant, nativity, United States; duration of insanity, three years and three months. Complications, acute delirium, pulmonary oedema and cardiac hypertrophy. Cause of death, pulmonary oedema and exhaustion of acute delirium.

AUTOPSY. *Head*—Skull cap of average thickness and density. Dura presented no abnormalities. Pia-arachnoid tough, not adherent but slightly thickened.

Brain—Weight 56¾ oz., convolutions of good size, sulci deep. No gross changes were observed in either the gray or white matter. The basal vessels presented no pathological changes.

Lungs—At upper portion of left pleural cavity anteriorly was a localized emphysema shut off by bands of adhesions. It was about three inches in diameter and extended from the first to the third rib. At each apex were old tubercular cicatrices.

Heart—Weight $9\frac{1}{2}$ oz., walls of left ventricle much thickened, cavity small, valves smooth and competent.

Liver, Spleen and Kidneys presented no gross changes.

AUTOPSY No. 138. CASE No. 595.—Male, aged 36, married, farmer; nativity, United States; heredity, father, mother and one sister insane; duration of insanity (present attack), three years and two months. Complication, typhoid fever. Cause of death, typhoid fever.

AUTOPSY. *Head*—Skull cap of usual thickness. Slight adhesions between it and the dura. Pia pale, not adherent, vessels collapsed.

Brain—Weight 50 oz., cortical substance pale, convolutions well developed, brain substance firm, sulci deep.

Lungs—Left normal, right bound down by adhesions in which were deposits of lime salts.

Heart—Weight $9\frac{1}{2}$ oz., muscle friable, valves competent.

Liver—Weight, 60 oz., firm, dark, congested, edges sharp.

Kidneys—Weight of left $5\frac{3}{4}$ oz., of right $5\frac{3}{4}$ oz., capsules not adherent, cortical and medullary portions normal in appearance.

Spleen—Weight $8\frac{3}{4}$ oz., soft and friable.

Small Intestines—Mucous membrane of jejunum red and injected. Mucous membrane of ileum was covered with mucus and debris, beneath which was an inflamed surface with an occasional ulcer.

Large Intestine—Mucous membrane was in a state of catarrhal inflammation and here below ileo-cæcal valve most of the ulcers were found. They were irregular in contour, with smooth bases and abrupt, well defined edges. Mesenteric, solitary and Peyer's glands much enlarged, but no ulcerations discovered.

AUTOPSY No. 152, CASE No. 661.—Female, aged 43, married, housewife; nativity, United States; duration of insanity, eighteen years. Complication, organic brain disease. Cause of death, asphyxia.

AUTOPSY. *Head*—Skull of more than average thickness, this being due to increase in thickness of diploë. Membranes were clear and not adherent; upon their removal 8 oz. of blood-tinged serum escaped.

Brain—Weight $41\frac{1}{2}$ oz., convolutions atrophied, brain tissue softened. Section of centrum ovale of right hemisphere revealed tough bands of white connective tissue radiating to all points of periphery. There was marked increase of the connective tissue in basal ganglia, causing atrophy of the various strata of gray matter. The lamina of the lenticular nucleus of right side could not be seen and appeared to be replaced by a long, narrow, contracted area of degeneration which served as a border to the nucleus and appeared as a fringe parallel to the claustrum.

Lungs—Congested, deeply pigmented; lymphatic glands, enlarged,

softened and dark-colored. Just below the isthmus of thyroid gland, in median line of trachea, was found the tracheotomy incision involving two rings. In the larynx below the glottis was a piece of orange two inches by one-half inch. The lining membrane of the air passages was coated with reddish, frothy mucus.

AUTOPSY No. 165, CASE No. 231.—Male, aged 27, single, gas and steam fitter; nativity, United States; heredity, brothers insane; duration of insanity, six years. Complication, typhoid fever. Cause of death, peritonitis following typhoid fever.

AUTOPSY. *Head*—Skull rather soft but of usual thickness, membranes normal.

Brain—Weight $50\frac{3}{4}$ oz., unusually soft, especially so in apices of temporo-sphenoidal lobes, vessels presented no gross lesions.

Lungs—Left pleuritic adhesions.

Heart—Muscle rather soft.

Liver—Weight 63 oz., unusually firm.

Spleen—Weight 12 oz., very large and firm.

Peritoneum—Was red and inflamed, coils of intestines dotted with flakes of lymph. The peritoneal cavity contained gas and fluid from the intestinal canal. In lower portion of ileum were found typhoid ulcers. The sloughs had been thrown off, but healing had not taken place in any noticeable degree. The perforation had occurred about four inches above the cæcum. The opening was clean cut and about $\frac{1}{8}$ of an inch in diameter. No indications of hemorrhage were found.

AUTOPSY No. 171, CASE No. 2051.—Male, aged 53, single, laborer; nativity, United States; heredity, sister insane; duration of insanity, fifteen months. Complication, carcinoma of bladder and kidneys. Cause of death, carcinoma of bladder and kidneys.

AUTOPSY. *Head*—Skull cap of irregular thickness, dura not especially adherent to skull. Pia slightly thickened but stripped readily from cortex; arteries at base were atheromatous.

Brain—Weight 46 oz., both gray and white matter considerably softened.

Lungs—Pleuritic adhesions at both apices.

Heart—Weight 9 oz., left ventricle hypertrophied and cavity diminished. Right auricle and ventricle contained organized clots, valves normal.

Liver—Weight $49\frac{3}{4}$ oz., surface smooth, tissue softened.

Kidneys—Weight of left 9 oz., of right $5\frac{1}{2}$ oz., right marked throughout by numerous areas of white, firm tissue. Left was very large; throughout its substance were light colored nodular areas some of which were an inch in diameter.

Spleen—Weight 5 oz., very dark color, soft and friable.

Stomach—Mucous membrane reddened, injected and thickened.

Bladder—The walls were greatly thickened measuring three-fourths of an inch; color pale, inner surface roughened.

AUTOPSY No. 189, CASE No. 1483,—Female, aged 37, widow, domestic; nativity, Ireland; duration of insanity, eleven and a half years. Complication, lobar pneumonia. Cause of death, lobar pneumonia. Contributing cause, chronic endarteritis.

AUTOPSY. *Head*—Calvaria normal, dura congested, not unduly adherent. Pia congested and reddened over left frontal lobe, along the sinuses it was marked by streaks of opacity. In no place were there any adhesions.

Brain—Weight $40\frac{1}{4}$ oz., convolutions firm and atrophied, sulci shallow and gaping. Interior of brain presented no gross changes.

Lungs—Left œdematous at base with broncho-pneumonic areas. The right was totally solidified, being in the stage of gray hepatization.

Heart—Weight $11\frac{1}{2}$ oz., muscle firm, mitral valve thickened and calcareous, aortic valve thickened and nodular with vegetations along its free borders.

Liver—Weight $38\frac{3}{4}$ oz.

Spleen—Weight $6\frac{1}{2}$ oz.

Kidneys—Weight of left $5\frac{1}{2}$ oz., of right 5 oz.; the three last mentioned organs presented no gross pathological lesions.

MISCELLANEOUS—FIVE CASES.

ACUTE DELIRIOUS MANIA.

AUTOPSY No. 126, CASE No. 1868.—Male, aged 26, single, barber; nativity, United States; duration of insanity, twenty days. Complications, none. Cause of death, acute delirious mania.

AUTOPSY. *Head*—Skull of irregular thickness, being especially thin in temporal fossæ and in frontal and parietal regions. Dura not thickened or adherent. Pia-arachnoid clear, firm, but not thickened; between the membranes was some clear fluid. Pia was slightly adherent over superior frontal convolution of right side along superior longitudinal fissure, causing erosions upon removal.

Brain—Weight 50 oz., convolutions of good size and firm consistence except for some softening of superior frontal convolutions. Arterioles of white matter very prominent. Nothing abnormal was discovered about basal ganglia, pons, medulla or ventricles. The walls of basal vessels were extremely thin.

Lungs—Left bound down by many pleuritic adhesions. Both were much congested.

Heart—Weight $8\frac{1}{2}$ oz., tricuspid valves and endocardium roughened. Aortic intima reddened.

Liver—Weight 52 oz., capsule adherent, tissue soft and yellow.

Spleen—Weight 3 oz., soft and friable.

Kidneys—Weight of left 5 oz., of right, $4\frac{1}{2}$ oz. In both the capsules were thickened and adherent, markings indistinct, cortices very thin.

AUTOPSY No. 162, CASE No. 2200.—Male, aged 36, single, cabinet-maker; nativity, United States; duration of insanity, unknown. Complications, acute endocarditis and acute meningeal encephalitis. Cause of death, acute endocarditis and acute meningeal encephalitis.

AUTOPSY. *Head*—Skull cap of very irregular thickness, in some places being very thin and in others abnormally thick. Dura thick, tough and firmly adherent to calvaria and to pia-arachnoid in region of Pacchionian bodies. Pia-arachnoid was much thickened and between its layers was a considerable quantity of serum.

Brain—Weight 54 oz., a few small erosions of cortex which was much softened. Section of brain showed it to be less firm than usual but revealed no gross lesions of basal ganglia, pons or medulla.

Lungs—No adhesions, both congested and oedematous posteriorly and at base.

Heart—Weight $10\frac{3}{4}$ oz., aortic valve thickened and incompetent, mitral valve smooth but reddened, lining membrane of left auricle much inflamed and dark in color, arch of aorta presented numerous white atheromatous patches.

Liver—Weight $56\frac{1}{2}$ oz., very firm, with adherent capsule.

Spleen—Weight $2\frac{5}{8}$ oz., soft.

Kidneys—Weight of left $5\frac{1}{8}$ oz., of right 5 oz., capsules stripped readily, color pale, cortical and medullary portion not clearly defined.

NOT INSANE—OPIUM HABIT.

AUTOPSY No. 142, CASE No. 1830.—Female, aged 44, single, domestic; nativity, United States; duration, four days (as stated in medical certificate). Complications, syphilis, chronic nephritis, and acute catarrhal bronchitis. Cause of death, acute catarrhal bronchitis; contributing causes, syphilis and chronic interstitial nephritis.

AUTOPSY. *Head*—Skull cap thickened, outer plate of frontal bone depressed, the depression being about four inches long and two inches wide. Dura not adherent and of normal thickness. Pia thick, adherent to dura in region of Pacchionian bodies; its vessels were engorged and their course marked by opacities.

Brain—Weight $49\frac{1}{2}$ oz., firm, convolutions well developed, no focal lesions observed.

Lungs—Mucous membrane of bronchi and bronchioles reddened, bronchioles filled with yellowish mucus. Both lungs were bound down by adhesions, the left was also adherent to pericardium, both were congested and marked in lower lobes by small hardened nodules.

Heart—Weight 17 oz., large, flabby, contained organized clot, cusps of mitral valve were of unequal size; no atheromatous areas or calcareous deposits were discovered.

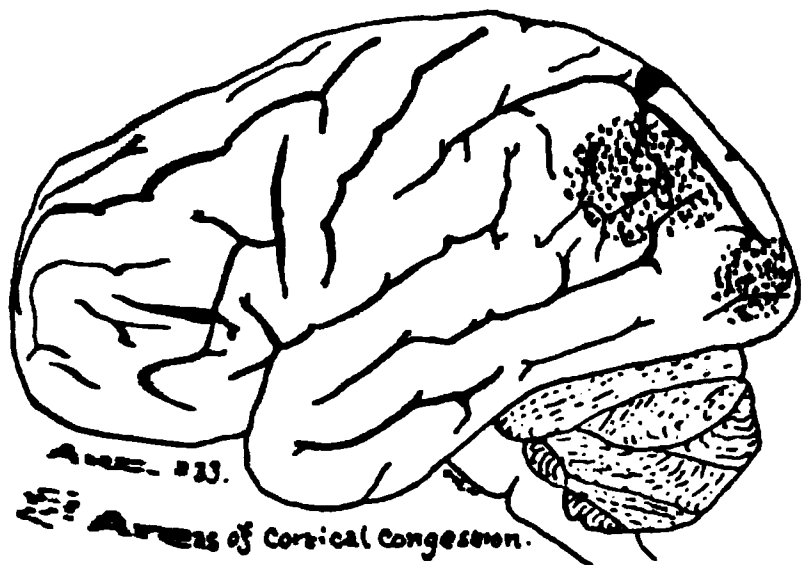
Liver—Weight 53 oz., large, soft and flabby, capsule discolored and marked by bands of cicatricial tissue.

Spleen—Weight 5 oz., of firm consistence, surface marked by yellowish areas.

Kidneys—Weight of left 5 oz., of right $4\frac{1}{2}$ oz., capsules of both light yellow in color but not markedly adherent. Surface of cortex very pale, firm, nodulated and marked by areas of dark red injection. Markings indistinct, fibrous structure increased.

IDIOCY.

AUTOPSY No. 133, CASE No. 1768.—Female, aged 36, single, occupation, not any; nativity, United States; duration, thirty-six years. Complications, acute cerebral meningitis and epilepsy. Cause of death, acute cerebral meningitis and epilepsy.



AUTOPSY. *Head*—Skull cap thick, hard and symmetrical. Dura not thickened or adherent. Pia-arachnoid deeply injected and distended with blood. Over the cerebellum in median line it was thick, dense and opaque. In all other portions the pia was attenuated and easily torn upon removal. Cerebro-spinal fluid less than one ounce.

Brain—Weight 48 oz., it was pressed tightly against cranial vault, causing convolutions to be much flattened. The angular gyrus of right side and that portion of the occipital lobe adjoining it was deeply injected and softened but not eroded. The gray matter was noticeably increased in thickness, the white being decreased. The centrum ovale was rough, elastic to feel and its puncta-vasculosa injected. Floor of fourth ventricle was softened, and thickened arterioles lay upon its surface.

Lungs—Both oedematous, with adhesions at apex of left.

Heart—Weight $6\frac{1}{2}$ oz., muscle firm, valves clear, smooth and competent.

Liver—Weight 31 oz., soft and very dark in color.

Spleen—Weight $2\frac{1}{2}$ oz., capsule thickened, causing contraction of organ.

Kidneys—Weight of left $3\frac{3}{4}$ oz., of right 4 oz., cortical substance increased, boundaries of pyramids indistinct.

IMBECILITY.

AUTOPSY No. 137, CASE No. 271.—Male, aged 20, single, laborer; nativity, Ireland; duration, congenital. Complication, epilepsy. Cause of death, cerebral softening.

AUTOPSY. *Head*—Skull cap of average density and thickness. Dura not adherent. Pia tough, thickened, opaque along the course of the vessels which were injected. It was adherent to cortex along longitudinal fissure.

Brain—Weight 47½ oz., convolutions large and well formed. At the tip of the left temporo-sphenoidal convolution was an area of softening one inch in diameter, and over this area the pia was very adherent. Upon section it was noticed that the cortex was increased in depth and firmness. Left hippocampal region very much sclerosed, vessels of brain enlarged and perivascular spaces distended. Remaining organs presented no gross pathological changes.

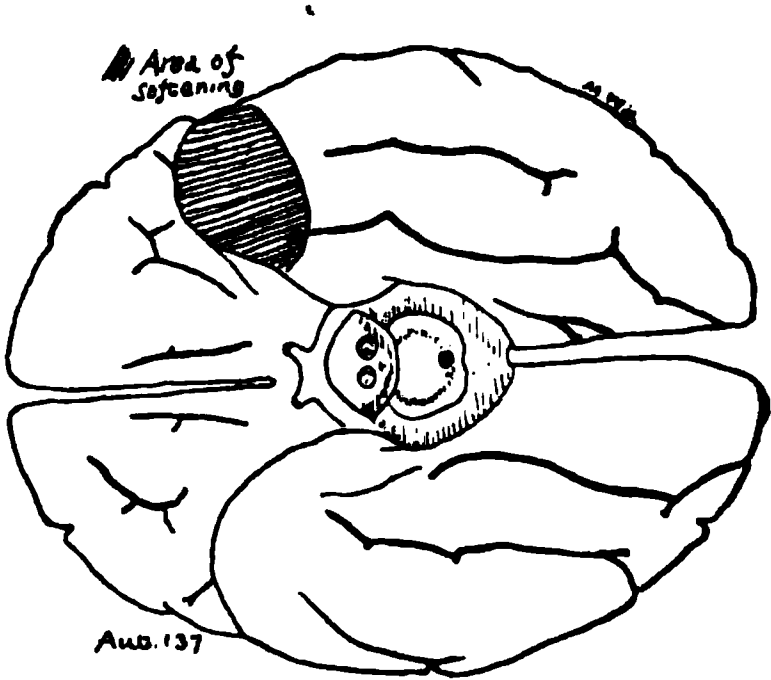


TABLE SHOWING THE DISEASED TISSUES AND ORGANS IN EACH AUTOPSY, WITH PER CENT.

		Form of Insanity.	Cerebral Membranes.	Cerebral Vessels.	Brain.	Lungs.	Heart.	Liver.	Kidneys.	Spleen.	Intestines.	Bladder.
Aut. No.	101	Gen. Par.	I	I	I	I	I	....	I	....	....	....
"	104	"	I	....	I	I	I	....	I	....	....	....
"	117	"	I	I	....	....	I	....	I	I	I	I
"	124	"	I	I	I	I	....	I	....	....	....	....
"	127	"	I	....	I	I	I	I	....	....	....	....
"	130	"	I	....	I	I	I	....	....	....	....	....
"	131	"	I	I	I	I	I	I	....	I	....	....
"	144	"	I	....	I	....	I	I	....	....	....	....
"	158	"	I	....	I	....	I	I	I	I	....	....
"	161	"	I	I	I	I	I	I	I	....	....	....
"	169	"	I	....	I	I	....	I	....	....	....	....
"	176	"	....	....	....	I	I	I	I	....	....	....
"	178	"	I	I	I	I	I	I	I	I	....	....
"	180	"	I	....	I	I	I	I	I	....	....	....
"	181	"	I	I	I	....	I	....	I	....	....	....
"	182	"	I	I	....	I	....	....	....	....	....	....
"	185	"	I	....	I	....	....	....	....	....	....	....
"	186	"	I	....	I	....	....	....	....	....	....	....
"	199	"	....	....	....	....	....	....	I	....	....	....
Per cent....			84 ¹ / ₁₀	42 ⁸ / ₁₀	78 ¹ / ₁₀	63 ⁸ / ₁₀	68 ⁸ / ₁₀	52 ¹ / ₁₀	52 ¹ / ₁₀	21 ¹ / ₁₀	51 ⁵ / ₁₀	51 ⁵ / ₁₀

TABLE SHOWING DISEASED TISSUES, &C.—(CONTINUED.)

	Form of Insanity.	Cerebral Membranes.	Cerebral Vessels.	Brain.	Lungs.	Heart.	Liver.	Kidneys.	Spleen.	Intestines.	Bladder.
Aut. No. 102	Dementia	I	I	I	....	....	I	I	I	I	..
" 103	"	I	I	I	....	....	....	....	....	....	....
" 105	"	I	....	I	I	I	I	....	....	....	....
" 107	"	I	I	I	....	I	....	....	....	I	....
" 108	"	I	....	....	....	I	I	I	....	I	....
" 109	"	I	....	I	....	I	....	....	....	I	....
" 110	"	I	I	I	I	I	....	....	....	I	....
" 115	"	I	I	I	I	I	....	I	I	....	....
" 118	"	I	....	I	I	....	I	I	I	....	....
" 121	"	I	I	I	I	....	I	I	I	....	....
" 122	"	I	I	I	I	I	I	I	....	....	....
" 123	"	I	I	I	I	I	I	....	I	....	....
" 125	"	....	....	....	I	....	I	....	....	I	....
" 132	"	I	I	I	I	....	I	I	....	....	....
" 135	"	....	....	....	I	....	I	I	....	....	....
" 136	"	I	I	I	....	I	I	I	I	....	....
" 140	"	I	....	I	....	I	I	....	....	I	....
" 141	"	I	I	....	I	....	I	I	....	I	....
" 148	"	I	I	I	....	....	....	I	I	....	....
" 153	"	I	I	I	I	I	....	....	....	....	....
" 154	"	I	I	I	I	I	I	I	I	....	....
" 156	"	....	....	....	I	I	I	....	....	....	....
" 159	"	....	I	I	....	....	I	I	....	....	....
" 160	"	I	I	....	I	I	I	I	....	I	....
" 166	"	I	....	I	....	I	I	....	I	....	....
" 173	"	I	....	....	I	....	I	....	....	I	....
" 175	"	I	....	I	I	I	I	I	....	I	....
" 177	"	I	I	I	I	I	I	I	....	....	....
" 179	"	....	....	....	....	I	I	I	....	....	....
" 183	"	....	I	I	I	I	....	I	....	....	....
" 184	"	I	....	I	I	....	I	....	....	....	....
" 187	"	....	....	....	I	I	I	I	....	....	....
" 194	"	....	I	I	I	....	I	I	....	....	....
" 196	"	I	I	I	I	I	....	I	....	....	....
" 197	"	....	....	....	I	I	I	I	....	....	....
" 198	"	....	....	I	I	I	I	....	I	....	....
Per cent.		72½	55½	72½	69½	63½	75	61½	27½	30½	
Aut. No. 114	Epileptic Dementia	I	I	I	I	I	....	I	....	....	....
" 119	"	I	....	I	I	I	I	I	....	I	....
" 120	"	I	I	....	I	I	I	....	....	....	....
" 143	"	....	....	....	....	....	....	I	I	I	....
" 145	"	I	....	....	I	....	I	I	I	....	....
" 146	"	I	....	I	I	....	I	....	....	....	....
" 147	"	I	....	I	I	....	I	I	....	....	....
" 188	"	I	I	....	I	I	I	I	....	....	....
" 195	"	I	....	....	....	I	....	....	....	....	....
" 200	"	I	....	I	I	....	I	....	....	I	....
Per cent.....		90	30	50	80	50	70	60	20	30	

TABLE SHOWING DISEASED TISSUES, &c.—(CONTINUED).

	Form of Insanity.	Cerebral Membranes.	Cerebral Vessels.	Brain.	Lungs.	Heart.	Liver.	Kidneys.	Spleen.	Intestines.	Bladder.
Aut. No. 106	Acute Melancholia	.....	.....	.....	I	.....	.....	.....	...	I	...
" 112	"	I	I	I	I	I	I	I	I	...	...
" 129	"	I	I	I	I	I	I	I	I	...	...
" 139	"	I	I	I	I	.....	.....	I	I	...	...
" 151	"	I	I	I	.....	.....	.....	I	.....	.....	...
" 163	"	.....	.....	.....	.....	I	I	I	.....	.....	...
" 167	"	.....	.....	I	I	.....	.....	I	.....	I	...
" 168	"	.....	.....	I	I	I	I	.....	.....	.....	...
" 172	"	.....	I	.....	I	I	.....	.....	.....	I	...
" 174	"	I	I	I	I	I	.....	I	.....	.....	...
" 190	"	I	.....	I	I	.....	I	I	.....	.....	...
" 191	"	.....	I	.....	I	.....	.....	I	.....	.....	...
Per cent. . . .		50	58⅓	66⅔	83⅓	50	41⅔	75	25	25	
Aut. No. 157	Chronic Melancholia	.....	.....	I	I	I	I	.....	.....	...	...
" 164	"	I	I	.....	I	I	I	I	.....	...	...
" 170	"	.....	.....	I	I	I	I	I	.....	.....	...
" 192	"	.....	.....	I	I	I	.....	.....	.....	.....	...
" 193	"	.....	.....	I	I	.....	.....	I	.....	.....	...
Per cent. . . .		20	20	80	100	80	60	60			
Aut. No. 111	Chronic Mania.	I	.....	.....	.....	.....	.....	I	.....	.....	...
" 113	"	I	I	I	I	.....	I	I	I	I	...
" 116	"	I	I	I	.....	I	I	.....	.....	.....	...
" 128	"	I	I	I	.....	I	I	.....	.....	.....	...
" 134	"	I	.....	.....	I	.....	.....	.....	.....	.....	...
" 138	"	.....	.....	.....	I	I	I	.....	.....	.....	...
" 152	"	I	.....	I	I	.....	.....	.....	.....	.....	...
" 165	"	.....	.....	I	I	.....	.....	.....	.....	I	...
" 171	"	I	I	.....	I	I	.....	I	I	...	...
" 189	"	I	.....	I	I	I	.....	.....	.....	.....	...
Per cent. . . .		80	40	60	70	40	40	30	20	20	

TABLE SHOWING DISEASED TISSUES, &c.—(CONTINUED.)

	Form of Insanity.	Cerebral Membranes.	Cerebral Vessels	Brain.	Lungs.	Heart.	Liver.	Kidneys.	Spleen.	Intestines.	Bladder.
Aut. No. 149	Acute Mania.	....	....	....	....	....	....	....	....	I	...
" 150	"	I	I	I	I	I	....	I	....	....	....
" 155	"	I	I	....	....	....	I	I	....	I	....
Aut. No. 126	Acute Delirium.	I	I	I	I	I	I	I	I	....	....
" 162	"	I	....	I	I	I	....	....	....	....	....
Aut. No. 142	Opium Habit.	I	I	....	I	....	I	I	I	....	....
Aut. No. 133	Idiocy.	I	....	I	I	....	....	I	I	....	....
Aut. No. 137	Imbecility	I	....	I	I	....	....	....	....	....	....
Total per ct.		74	47	69	73	58	59	58	25	18	

OBLITERATION OF PERICARDIUM.

REPORTED BY EDGAR J. SPRATLING, B. S., M. D.,
Second Assistant Physician, Matteawan State Hospital.

In June, 1895, there was admitted to the Matteawan State Hospital, a patient of robust, healthy physical appearance; no knowledge as to his past could be obtained. April 20th, 1896, he was at work outside the buildings and presented no evidence whatever of bodily debility. On May 8th he remained in from work, complaining of feeling tired and at times experiencing slight pains in the chest. At this time examination gave oedema of feet and ankles, slightly increased cardiac area of dulness, some muffling of heart sounds and at times in certain positions pericardial friction could be made out, and after exertion

dyspnœa was noted. Condition steadily grew more threatening and on May 20th the following note was made: "Patient unable to exert himself in any way, lying with head and chest elevated, any movement, active or passive, increasing the already great difficulty in breathing, urine and fæces are passed while thus placed, œdema marked in every region of the body, skin livid, dyspnœa most distressing, eyes bleared and bulging, nostrils flaring and whole countenance expressive of terror, speech low and indistinct, no heart sounds can be heard, passive hypostasis noticeable; placed under special nurse as dissolution seems near." This condition changed but little for sixty days, except in the development of numerous small areas of static gangrene. Patient was receiving regularly at frequent intervals digitalis or strophanthus with egg-nogs and milk punches.

Death occurred July 20th, the post mortem giving: great quantities of fluid in every cavity, all tissues œdematous, the viscera being otherwise normal except the brain (patient being a paretic) and heart together with its region; there the following was found—valves intact, slightly hypertrophied endocardium and muscle soft and spongy, pericardium entirely absent leaving only numerous strings and ribbons that firmly united the heart and surrounding structures, the pericardial sac being entirely obliterated; every evidence of a continued very active inflammation was present, but no pus or pus sacs could be found.

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A TENTATIVE EXPLANATION OF SOME OF THE PHENOMENA OF INHIBITION ON A HISTO-PHYSIOLOGICAL BASIS, INCLUDING A HYPOTHESIS CONCERNING THE FUNC- TION OF THE PYRAMIDAL TRACTS.

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As the condition of the reflexes in destructive supra-lumbar lesions of the spinal cord seems especially well adapted for the application and test of the theories outlined in this paper, the text is presented largely in the form submitted in the writer's discussion of Dr. Fränkel's paper on the above subject* read at a meeting of the New York Neurological Society, April 6th, 1897.

Fränkel presented several cases of destructive supra-lumbar lesions with autopsies and, as is the case with other examples in the literature of the subject, recorded absence of the patellar reflexes notwithstanding the fact that the lumbar cord was normal excepting descending degenerations.

Fränkel explains this absence of the knee-jerk by maintaining that the simple spinal reflex arc consisting of the sensory neuron from the periphery, its connection with the anterior horn cell and transmission of the impulse centrifugally to the muscles through the motor spinal neuron, is not alone sufficient for the production of the knee-jerk. Besides this simple reflex arc making a circuit

* The Condition of the Reflexes in Supra-Lumbar Lesions of the Spinal Cord,
by Dr. Joseph Fränkel.

from the sensory periphery of the body to the muscles through one or more segments of the spinal cord, a second arc is concerned with the production of the knee-jerk.

This second arc consists in a set of vertical ascending and descending cerebellar neurons which connect the simple transverse spinal reflex arc with the cerebellum. Hence when these ascending and descending cerebellar constituents of the reflex mechanism are destroyed by transverse lesions of the cord, the reflex is lost although the segments of the spinal cord concerned with the simple reflex arc are intact.

Fränkel has furthermore shown that clinical facts force us to the conclusion that the cerebellum exhibits a tonic influence upon the motor anterior horn cell which is in response to, and maintained by means of, those pathways which convey the sensory impressions from the muscles, tendons and joints to the cerebellum. The tendon reflex is further influenced from the cerebral hemisphere and it is to exclude this latter influence that we employ Jendrassik's device, or try in other ways to distract the patient's attention from the test.

The writer entirely agrees with Dr. Fränkel's views of reflex mechanism and desires to support his deductions from another point of view. This, however, leads me to introduce a hypothesis regarding the mechanism of so-called *inhibition*.

As we all know, many physiological facts can hardly be explained otherwise than by assuming the presence of so-called inhibitory, moderating, or regulating nerve fibres or nerve apparatus. I remind you of the fact that excitation of the pneumogastric nerve retards the action of the heart; that excitation of the splanchnic nerve arrests the movements of the stomach and intestines; that, on the contrary, severance of the splanchnic nerve gives rise to increased motion of these parts.

Numerous similar facts could be mentioned. I shall only point out, however, as being in closer touch with the subject under discussion, that such inhibitory or modera-

ting influence is also ascribed to the cortico-spinal motor fibres forming part of the pyramidal tracts.

Although again and again the theory of inhibition has been resorted to for the explanation of this or other kinds of phenomena, as for instance, also, to explain the exaggeration of the knee-jerks in case of disease of the pyramidal tracts, nobody has yet, to my knowledge, attempted to give an anatomical and physiological basis to such theory. No one, it appears, has tried to give an idea what manner of connections must be postulated for excitation of a given neuron and what connections are required to facilitate inhibition of the action of such a neuron. Or, as we might also formulate it, nobody has yet called attention to the view that presumably the direction of the nerve current as required for the inhibition of a cell, might be directly opposite to the direction of that current which acts in the sense of excitation.

The theory which I have to offer in this respect can be formulated as follows:

For the excitation of a nerve cell, the nerve current has to pass in the direction from the cell body or its protoplasmatic processes toward the nervous process; for the inhibition of the cell, the nerve current has to pass in the opposite direction, that is from the nerve process, or its collaterals, back to the cell body. In other words, to produce excitation of a given cell, the nerve current must enter this cell from the surface of its cell body or of its dendrites; but in order to inhibit or moderate the action of the cell, the nerve current has to enter the cell from its nerve process or collaterals thereof.

These two modes of action are best illustrated by the diagrams No. 1 and No. 2. In both these diagrams the nerve processes have been drawn with red color, so as to distinguish them easily from the protoplasmatic processes. For both figures the same neuron A has been chosen. Fig. 1 shows this neuron A under the influence of excitation from the neurons B and C. Fig. 2 represents neuron A under the influence of inhibitory action from the neuron D.

Now the connections represented in these diagrams are not altogether theoretical, for they have been actually found. You will see this from the two drawings which have been copied from Lugaro's article* on the finer structure of the cerebellar cortex, Figs. 3 and 4. In Fig. 3 we see the terminations of an axis cylinder clinging to the protoplasmatic processes and cell body of a Purkinje cell. In Fig. 4 we find the terminations of the nerve processes of three neurons A, B and C coming in quite close touch with each other.

The objection might be raised that in the peripheral sensory neuron, which has its cell of origin in the spinal ganglion, the normal stimulation passes from the periphery through the peripheral ramus of the nervous process towards the cell body and that the traveling of the impulse in this direction causes excitation and not inhibition of this cell, as might be expected from the theory given. But we know also that originally the spinal ganglion cell is bi-polar and that the T branching process has been created by the union of two formerly separated processes. Furthermore, the investigations of Lenhossek and Retzius, on the invertebrates make it highly probable that the peripheral ramus of the T shaped fibre of the spinal ganglion cell is actually not a nerve process, but the homologue of a protoplasmatic process. If we look at the matter in this light, and there are at least as many points in favor of this view as against it, the theory still holds good.

It might further be objected that the nerve current entering the neuron A through the collateral α (see Fig. 2) after arriving at the branching point g , would divide into two currents, one of which would take a cellulipetal, the other a cellulifugal direction. Such an objection can be refuted, however, if we adhere to the theory of the fibrillary structure of the nerve process, for in accordance with this theory an individual set of fibrillæ would become separated from the main body of neuraxial fibrillæ and

* Rivista Sperimentale di Freniatria, Vol. XX, Fasc. III-IV, 1894.

pass out independently in the collateral α . Hence the inhibitory impulses passing in the direction of the arrows from the neuron D to the cell of neuron A ought not to leave the individual set of fibrillæ passing out in the collateral α .

Let us now apply the hypothesis to the subject under discussion. Doctor Fränkel has presented the view that the cerebellum maintains a tonic innervation on the motor anterior horn cells. In accordance with my theory the fibres causing this tonic innervation ought to end with their terminal arborisations in such a manner that these arborisations cling to the *protoplasmatic processes* or to the cell body of the motor anterior horn cells.

On the contrary, we should assume that the terminations of the cortico-spinal pyramidal fibres come in close contact with the terminations of a *collateral of the nervous process* of the motor anterior horn cell. In other words, the cerebellar motor fibres have an exciting, and the pyramidal fibres an inhibitory influence on the peripheral motor neuron. I venture to enlarge my hypothesis and go so far as to say that the pyramidal fibres or, as we might more exactly call them, the fibres of the cortico-spinal tract, have in the main, perhaps even exclusively, an inhibitory and in this sense regulating or moderating action upon the peripheral motor neuron.

This hypothesis is perhaps not as strange as it looks at first sight. The investigations of van Gehuchten and others make it highly probable that there must be at least one other motor pathway than the one we have known heretofore, namely, the pyramidal tract. Déjerine,

Flechsig and van Gehuchten* find that part of the fibres originating from cells of the cortical motor district separate themselves from the main pyramidal tract and end in the gray masses of the pons. From these pontial gray masses another tract of fibres arises which passes into the cerebellum from which in all probability a new tract of fibres continues the pathway to the anterior

* Van Gehuchten. Journal de Neurologie et d'Hypnologie, 1897, No. 13.

horn cells of the spinal cord. For the investigations of Marchi, Kœlliker, Biedl, etc.,* tend to prove that a centrifugal tract, originating from the cerebellum enters the lateral column of the spinal cord, and apparently becomes in one way or another connected with the peripheral motor neuron. Only Kœlliker thinks that this tract is interrupted in the olivary bodies, while Marchi and Biedl assume that it is a direct uninterrupted pathway. At any rate we must assume that the motor district of the cerebral cortex can act upon the motor peripheral neuron not only by the pathway of the cortico-spinal tract, but also through the intervention of the cerebellum. (See Fig. 5.)

Now I am inclined to assume that the voluntary excitation of the peripheral motor neuron occurs mainly by means of the pathway going through the cerebellum, perhaps, also, by some other motor pathway, and that the cortico-spinal pyramidal fibres have an almost exclusively inhibitory action, that is, an action which is moderating or regulatory upon this neuron. You will find this statement somewhat less paradoxical if illustrated by a practical comparison. You will admit that in placing a rubber band around this box, I can raise its cover in a much more regular, gradual manner than when the rubber band is omitted. In other words, I can graduate this motion of the cover of the box much better by opposing a resistance.

Another example is the following: In the application of the galvanic current, we prefer to regulate the amperage by means of rheostats instead of regulating it by increasing or diminishing the electro-motor force, as we do when we change the number of cells. Thus it can be seen that the cortico-spinal pyramidal tracts lose none of their importance in motor function by the application of my theory.

At this juncture it is essential to mention van Gehuchten's important discovery that in the foetus of seven months the pyramidal tracts are still entirely absent throughout the whole length of the spinal cord. In other

* Quoted from van Gehuchten l. c.

words, at this period, those axis cylinders of cerebral cortex cells which grow downward to form the pyramidal (cortico-spinal) tracts have not yet reached the spinal cord in their downward growth. They only reach the cervical portion of the cord during the eighth month of intra-uterine life. Yet we know that children born at this period can move their limbs.

Van Gehuchten explains many cases of Little's disease in this manner and calls attention to the fact that in this special class of cases there is no actual paralysis but only rigidity and spasticity; further, that these cases usually recover and that the spastic symptoms disappear from above downwards; that, in other words, the spasticity and rigidity remain longest in the lower extremities. This is in harmony with the fact that the pyramidal fibres in their developmental downward growth reach first the cervical, and at last the lumbar and sacral portions of the spinal cord.

It seems to me that these findings may serve also in support of my hypothesis, for van Gehuchten's researches ^{thus} show that voluntary motions exist when the function of the cortico-spinal pyramidal tracts is absent.

Therefore, at least one other motor pathway connecting the cerebral cortex with the peripheral motor neuron must be present. These researches furthermore tend to corroborate the view that this other motor pathway which, in harmony with the views of van Gehuchten and others, we have assumed to pass through the cerebellum to the spinal cord, has chiefly an exciting influence upon the peripheral motor neuron, whereas, on the other hand, the cortico-spinal division of the motor tract (pyramidal tracts), influence the peripheral motor neuron in an inhibitory or regulatory sense.

I shall have to prove yet that the cortico-spinal pyramidal fibres are indeed connected with the peripheral motor neuron, in the manner mentioned (see Fig. 5); or, at least, that the anatomical facts known heretofore do not exclude such manner of connection. We have in the first line to

prove that the axis cylinder of the motor anterior horn cell gives off collaterals. Now the researches of Lenhossek, not only confirm the existence of such collaterals, but reveal the other significant fact that he found such collaterals with constancy in mammals but could not find them in the fish, amphibia and reptiles; indeed he is convinced that in these animals they are absent. This fact I believe is significant and strengthens my hypothesis, for, according to Edinger's statement, only mammals possess a direct cortico-spinal motor pathway, and such is not present in the lower vertebrates. I must not omit to mention in this connection that Lenhossek also attributes a centripetal function to these collaterals although he makes no allusion to the possible nature of this function. As to the manner of connection of the terminal arborisations of the pyramidal fibres with the peripheral motor neuron, nothing definite is known, but no anatomical facts have been presented which would contradict the manner of connection which I would ascribe to them, and which is illustrated in Figure 5. Here α represents a cortico-spinal fibre of the pyramidal tract.

I have expressed the belief that the cerebral motor district acts upon the peripheral motor neuron not only through the cortico-spinal pyramidal fibres, but also by the intervention of the cerebellum through the cortico-cerebellar-spinal division of the motor tract. But the cerebellum can also influence the anterior horn cell independently of the cerebral hemispheres. It exhibits a tonic innervation of the peripheral motor neuron, and this tonic innervation is evidently kept up in response to a constant stream of impulses from sensory nerve fibres ascending from the spinal cord. See Fig. 5, f, g, h^1, i .

In the test of the knee-jerk, the peripheral motor neuron is thus acted upon from three sides:

First.—From the peripheral sensory nerve fibre, probably through a collateral thereof. Fig. 5, f, g, h^2 . According to my theory we shall assume that the termination of this collateral clings to the protoplasmatic processes or to

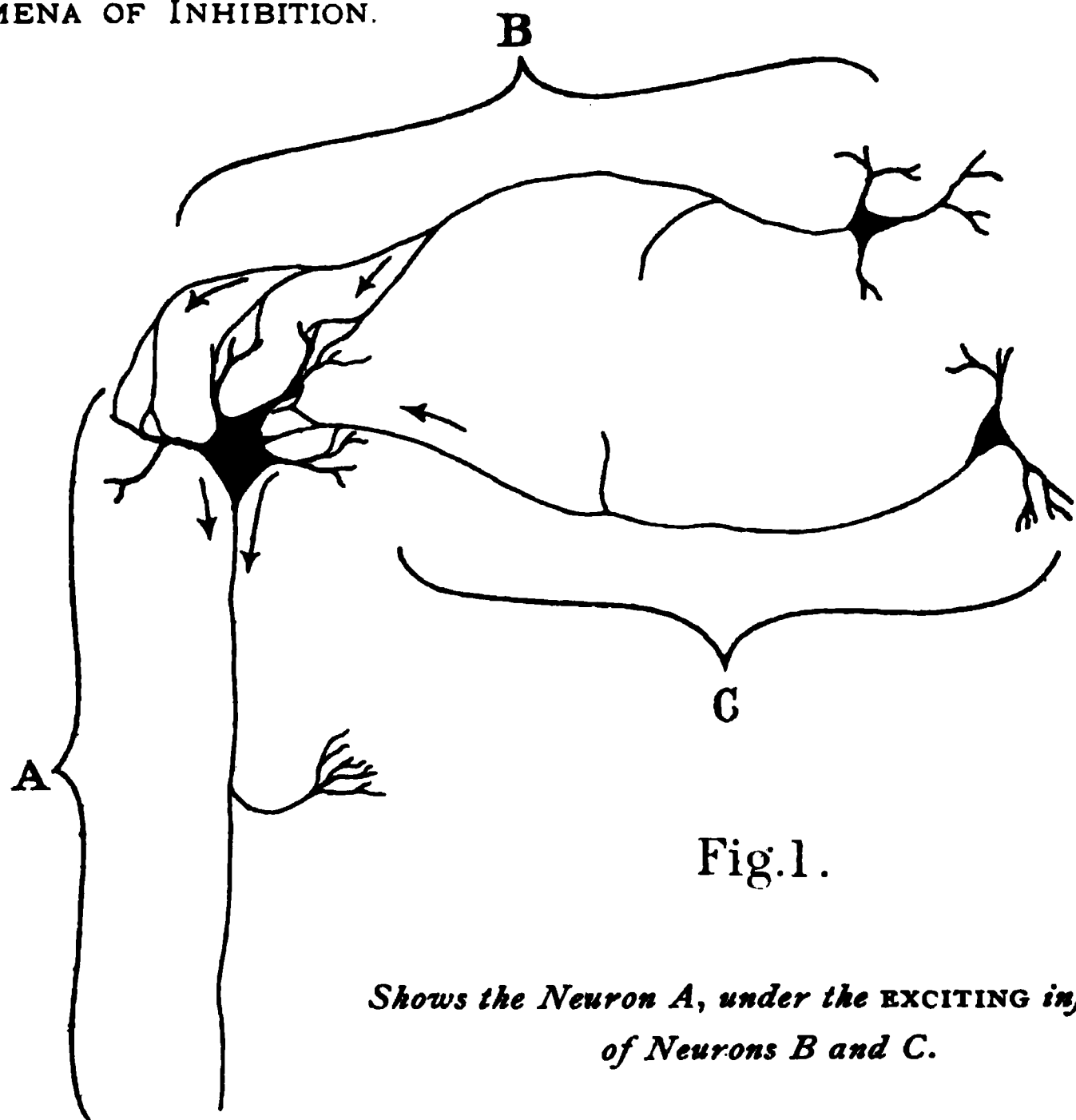


Fig.1.

Shows the Neuron A, under the EXCITING influence of Neurons B and C.

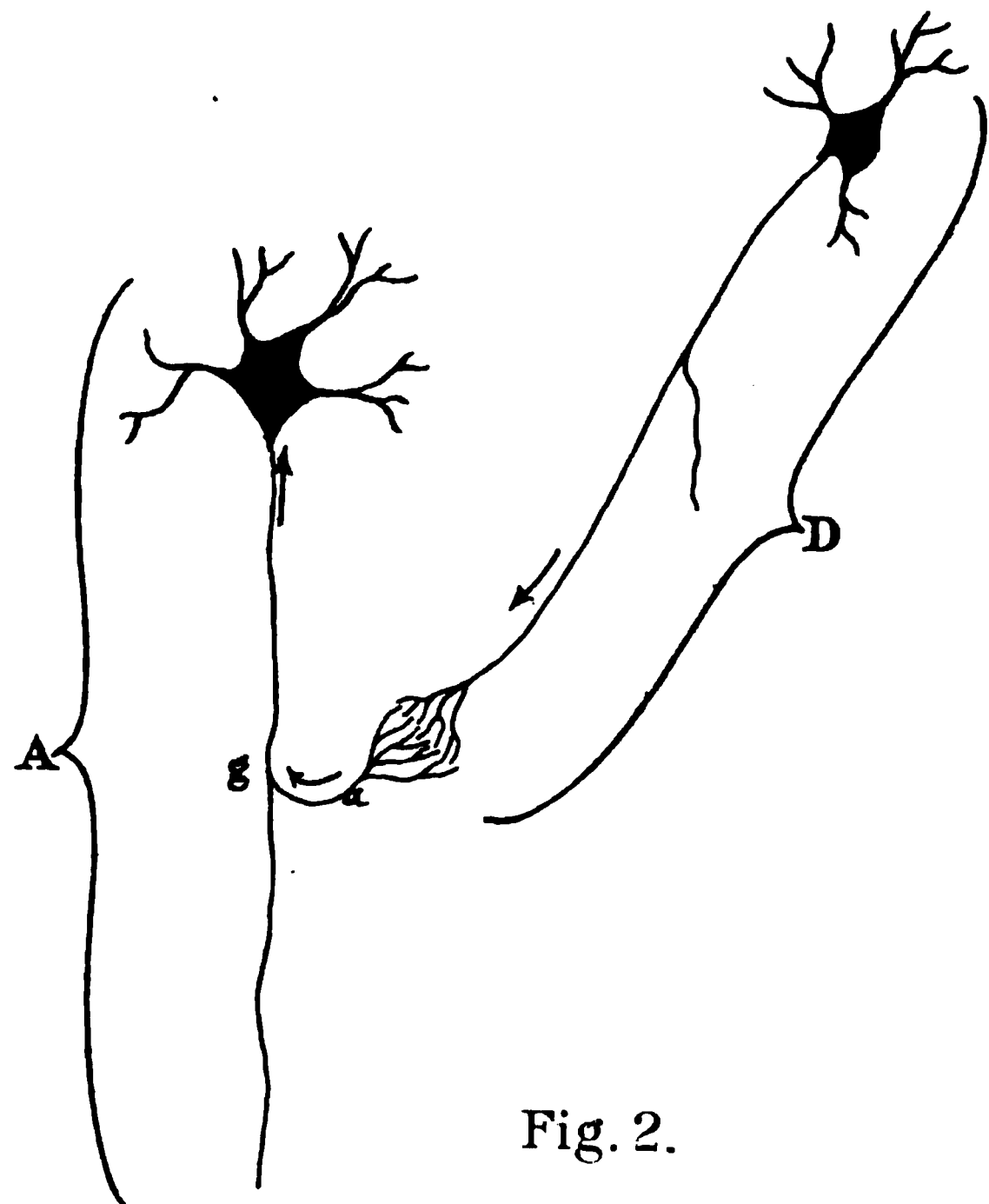


Fig. 2.

Shows Neuron A, under the INHIBITORY influence of Neuron D.

The direction of nerve current is indicated thus →
The nerve processes are colored red.



Fig. 3.

Shows connection of the Neuraxon of the cell x with the dendrites of the two Purkinje cells, which would initiate impulses of excitation in these cells.

B C

Fig. 4.

The Neuraxons A, B, C, here appear in contact with each other through their collaterals, which would fulfil the conditions of inhibitory impulse.

The above two figures (3 and 4) are copied from drawings in Lugaro's article on the connections between the nerve elements of the cerebellar cortex.



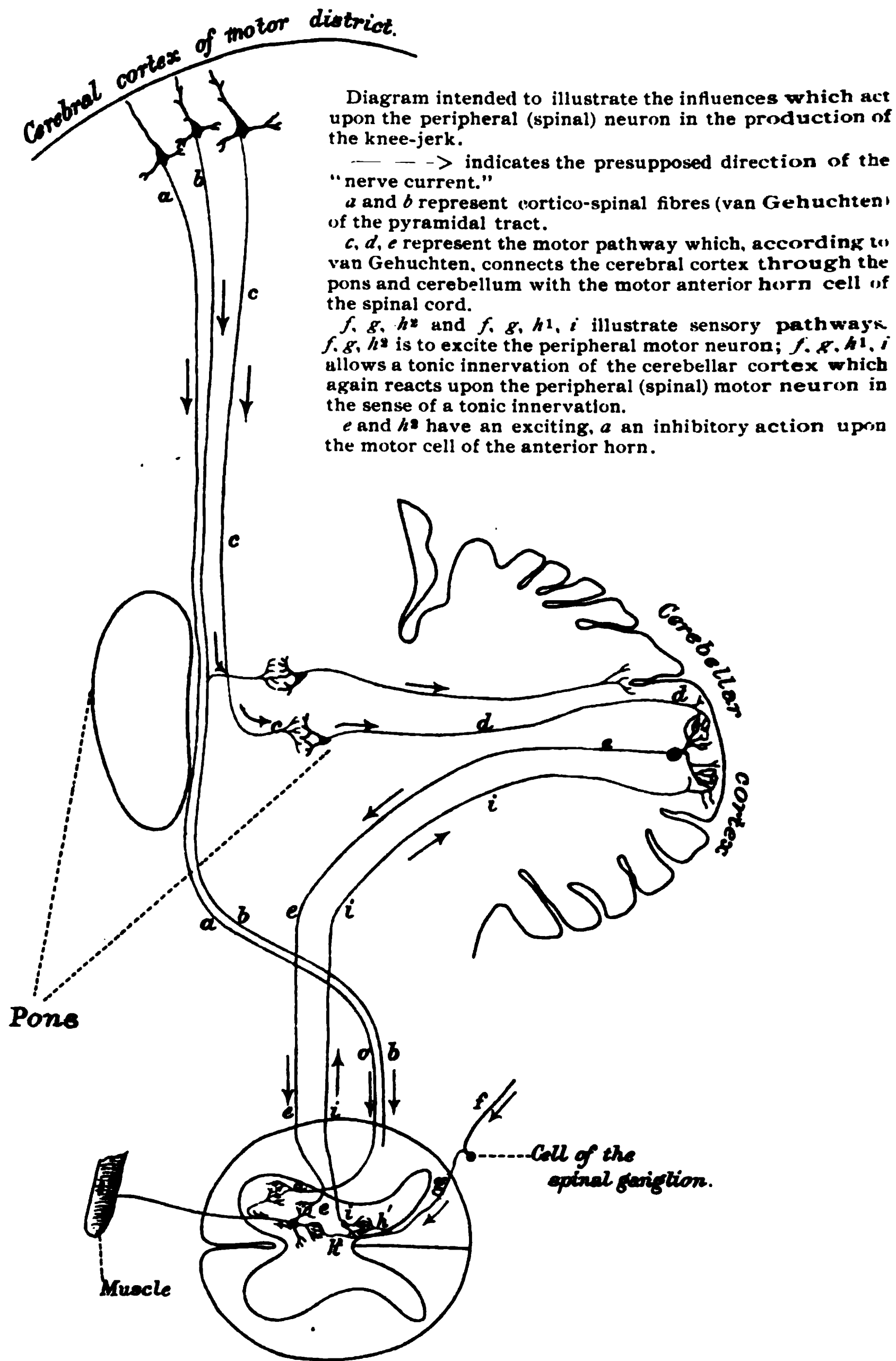


Fig. 5.

the cell body of the peripheral motor neuron, since the peripheral stimulus causes excitation of the cell.

Second.—From the cerebellum, which maintains a constant stimulation of the peripheral motor neuron as explained above, and which must therefore be connected in the same manner with the motor anterior horn cell, as is the peripheral sensory fibre, that is, the connection necessary for excitation. Fig. 5, *e*, *c*, *e*.

Third.—From the cortico-spinal fibres, which have an inhibitory action, and thus counteract the other two instances. Fig. 5, *a*, *a*.

Assuming all this to be the case, interruption of the cortico-spinal pyramidal fibres will give rise to exaggeration of the knee-jerk by loss of the inhibitory influence. Interruption of the cerebello-spinal motor tract will cause absolute loss of the reflex, as the sensory stimulus coming from the tendon will be entirely counteracted by the inhibitory action of the pyramidal fibres.

Adhering to the theory given, we ought to conclude that interruption of the motor cerebello-spinal pathway would lessen the reflex in a higher degree than total transverse lesion of the spinal cord above the spinal reflex arc. But practically the result might be the same, that is, in case of complete transverse supra-lumbar lesion, the peripheral sensory stimulus, which alone remains active, may not be sufficient to produce such excitation of the peripheral motor neuron as to lead to a perceptible contraction of the quadriceps muscle.

For the present I refrain from further applications of the theory advanced.

I am aware of the fact that this theory offers some points of criticism, and that anatomical and clinical data may constrain me to modify this plan or perhaps to abandon it altogether. But, since there seems to be no distinct formulation of the mechanism of inhibition in the central nervous system, as intimated by the title of this paper, this theory is presented in a tentative way as a working hypothesis until a more comprehensive explanation of inhibition shall appear.

ELECTIVE SURGICAL WORK IN STATE HOSPITALS FOR INSANE.

BY WARREN L. BABCOCK, M. D.,
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The subject of operative surgery is one worthy of careful attention by alienists. The standard of qualifications upheld by the Civil Service Commission demands the highest attainment along general medical lines, but takes little account of the candidate's knowledge of surgical methods or technique. True, it is not expected that each interne or assistant be a full-fledged surgeon, but his knowledge of the principles of surgery should be proportionate to his knowledge of the principles of medicine. With the exception of the Manhattan State Hospital, our institutions are without official consulting surgical specialists. Nearly every State hospital has a surgeon in its vicinity willing to give his services gratuitously in emergency cases. To call upon this gracious donor in elective cases is humiliating in the extreme. We should, therefore, be prepared to carry out elective surgical procedures whenever indicated. It is not my intention to refer to the subject of the surgical treatment of insanity further than to disclaim any intention of discussing it here.*

With an almost limitless field for beneficial operative work; with every instrumental assistance at our command and, in many instances, with the requisite technical skill and experience, we have year after year allowed cases to come into our care and pass from it without having operable deforming or jeopardizing physical conditions relieved. Fully one-half, if not more, of the medical officers of our State institutions have had general hospital training previous to their appointment. But the adoption of mental

* The most comprehensive and recent discussion on the surgical treatment of insanity occurred at a meeting of the Medico-Psychological Association, held in Washington, May 3, 4, 5 and 6, 1892. See American Journal of Insanity, Oct., 1892.

diseases as a specialty has been the signal for discarding surgical work except in emergency cases. Absorption of interest and energy along psychiatric lines evidently soon disperses special skill along general medical and surgical lines. The embryo surgeon becomes an alienist and, concentrating his attention upon the mental condition of his patient, overlooks a torticollis, which limits the capabilities of a laborer; or an operable hernia, which hazards the life of a convalescing case; or a pathological ovary, which makes a chronic invalid of a woman. He may console himself with the thought that his patient has always or long had a torticollis; that he will recover without the assumption by the physician of the responsibility of a radical operation for hernia; or that the woman with a pathological ovary was sent to the hospital to have her mind cured and not her ovaries removed.

I do not wish to be misunderstood as recommending indiscriminate operative surgery. This work in all State hospitals should be performed only by the superintendent, the senior medical officers or a staff member particularly fitted by experience or skill. In most hospitals the administrative work is so great as to prevent the superintendent from personally performing special medical or surgical work. It here falls to the province of the senior medical officers. Distaste, lukewarmness or lack of confidence, often prevents us from carrying out beneficial surgical work which would be unhesitatingly performed in one of our modern city hospitals, to the great benefit of the patient and to the credit of the institution. Where a distinct pathological condition exists, not necessarily dangerous to life, but deleterious to good health and comfort, it is our plain duty to give such relief as the present status of surgery and our abilities command. If the deformed, maimed or handicapped sane person be permitted such relief as advanced surgery can give along reparative or plastic lines, why should not the insane derive like benefit? As a class the latter are, by heredity and by accidents particularly frequent among them, more often

congenitally deformed and crippled than their sane companions. As examples may be cited the special frequency of strabismus, congenital torticollis and harelip among idiots and imbeciles; the prevalence of gross syphilitic lesions, muscular contractures, hernias and a variety of minor conditions.

Literature on the subject of elective surgery does not exist, but surgery looking towards the relief of existing mental disorders boasts of an extensive bibliography. The number of surgical measures, however, which will usually benefit conditions of mental aberration are, unfortunately, in inverse proportion to the literature on the subject.

The care of an insane person following operation is often very trying. In disturbed cases the use of a camisole or protection sheet may be found necessary in order to immobilize the site of the operation. Suicidal cases may attempt to undo the good that may have been accomplished by the surgeon. Cases of dementia or general paralysis will usually interfere with the dressing. While the insane generally bear operations well, the after treatment is often a cause of much anxiety. If the possibilities of excitement and interference with dressings be borne in mind, the necessary precautions may be taken immediately after the operation.

Never operate without the written consent or presence of the patient's relatives even though the risks be slight. In most cases this will be readily granted, if the benefits of the operation be judiciously set before them.

It will sometimes be found that convalescence following operations upon the insane is attended with decided mental improvement, occasionally passing on to recovery, even in cases where the condition relieved had no bearing upon the mental disorder. Such a gratifying outcome in a few cases may be properly attributed to the shock of the operation. The changed environment following has a good influence on certain cases as the patient may be taken from a disturbed ward, where he receives a mini-

most amount of attention, to the sick room, where he is the centre of interest and solicitous care on the part of both physicians and trained nurses. In the following case an operation for torticollis was the starting point of a complete mental recovery:

"CASE No. 2539.—Admitted August 21, 1896, suffering from acute mania of several weeks' duration. Age 43; sailor; family history defective, father intemperate and died insane; sister committed suicide. Patient intemperate and dissolute; contracted syphilis at age of 23. Face and head asymmetrical; right sterno-cleido-mastoid greatly contracted producing an extreme torticollis which had existed for twenty-five years and entirely prevented rotation of head to right. Physical health good.

Patient continued disturbed and delusional for several months. On December 4th while still mildly disturbed and demonstrative he was anæsthetized, right sterno-cleido-mastoid divided near attachment to clavicle and sternum. Head and shoulders were immobilized in plaster cast and jacket. Cast was kept on for five weeks; stitches were removed and wound dressed through fenestra. Following operation and under forced rest, changed environment and careful nursing patient's mental condition began to improve. When cast was removed he was quiet, rational and orderly and had abandoned his delusions. He steadily continued to improve both mentally and physically and was discharged recovered, April 12, 1897. Head formerly at an angle of about 30 degrees, was then within two or three degrees of the median line. Rotation to the right, formerly impossible, was nearly as good as opposite side. Mental recovery seemed complete."

In the St. Lawrence State Hospital during the past year a number of surgical disorders have been relieved and the comfort of many patients enhanced without increasing the mortality statistics. Some of the procedures have been extremely simple from a broad point of view, but to the individual case, can not have failed to relieve conditions which were at least discomforting, or, in some cases, hazardous to continued health. As an instance of the latter may be cited unreduced hernias, particularly in disturbed cases where a truss can not be worn.

During the year ending February 1, 1897, thirty-two elective operations of all kinds, exclusive of lumbar puncture, opening of abscesses, etc., were performed.

Lumbar puncture for the relief of cerebral pressure in general paralysis and other diseases was carried out forty-four times.* It would serve no useful purpose to report the various operations in detail, but an enumeration of the special surgical conditions common among the insane and permitting operative relief may be of interest. Generally speaking, these conditions may be divided into two classes:

(a) Operable diseases or conditions which may be *optional or obligatory* owing to the circumstances of the individual case.

(b) Operable diseases or conditions, *always optional* and never alone hazardous to life.

In the first class occur all hernias, the surgical relief of which becomes *obligatory* if they become strangulated, or remains *optional* if non-strangulated. Cases under consideration for oöphorectomy may likewise be elective or obligatory, depending upon the nature or extent of the pathological condition present; its influence on the mental condition of the patient or on possible future pregnancies. Diseases or conditions remediable by surgical procedure and, under ordinary circumstances, compatible with health, but under extraordinary circumstances, proving rapidly fatal or extremely hazardous, should always, at least in our State hospitals, be subjected to the needful operation while the case is an elective one. Then the time, place, preparation for operation and manner of operating, is entirely at the will of the operator. The results will be incomparably superior to those obtained by the surgeon, who waits to be called upon short notice, perhaps at night, with no assistance, and but a few minutes in which to operate.

Many of our patients, especially those who come from the poorer class and live in country districts, have never realized that a surgical operation might rid them of their disease or deformity. Perhaps they never had the service of a physician or, if so, he overlooked or passed by the

* See STATE HOSPITALS BULLETIN, Vol. I, No. 3.

condition under consideration. We have the means in our hands, with little or no extra trouble and expense, of conferring such benefit as surgery offers, upon a class of people who would otherwise carry through life a serious deformity or defect. Handicapped in the struggle for existence on account of their being or having been insane, they are doubly distanced by reason of having a torticollis, a deformed limb or a hernia. In most elective operations the risks, as regards a fatal issue, are slight or practically *nil*. If these cases are not relieved while in the institution, their chances for future relief greatly diminish on their discharge, while in some instances, such as irreducible hernias, malignant growths, cataracts, etc., the risks continue, or increase with advancing age. In the majority of surgical diseases there is never any tendency for unassisted or spontaneous cure or relief as in general physical disease or even as exists in some surgical emergency cases.

In the second division (*b*) the demands for surgical relief may not be so imperative. Here it is advocated solely to promote comfort or improve the personal appearance of the patient. Representative examples of this class are operations for hare-lip and strabismus, skin-grafting and rhinoplasty.

Radical Cure of Hernia.—The encouraging results obtained by modern methods justify extensive elective work in restoring organs to their normal location. In males inguinal hernia is always a menace. Strangulation, incarceration and direct injury are possibilities existing from the beginning of the smallest rupture. If severe in degree, it generally incapacitates and is always discomforting. Any anatomical hiatus may be the point around which delusions centre. A former patient, until his death, maintained that his hernial protrusion was a mouse under the skin. He would not permit the hernia to be reduced as he preferred to have the mouse under the skin rather than in his abdomen. It would be interesting to know how an operation would have influenced his delusion.

During the past year eight operations for the radical cure of hernia were performed in this hospital. All cases were males, five were left, two right and one double inguinal hernia. The eight comprised cases of dementia, the chronic disturbed and convalescents. At the present time none of the hernias have recurred, although a period of from ten to sixteen months has elapsed. Bassini's method or Halstead's modification was carried out in each case as far as local conditions would permit. The hernias varied from small reducible ruptures to large and pendulous sacs of intestine. The uniform good results obtained encourage us to contemplate the radical cure of all cases where the hernia interferes with the daily vocation of the patient or occasionally becomes strangulated.

Operations upon the Eye.—Cataract, pterygium, strabismus, dacryo-cystitis, ectropion, entropion, staphyloma, etc., are elective surgical disorders of the eye more frequently neglected than relieved. Four cataracts have been removed with restoration of vision in two cases. In one, an accident occurred which illustrates the necessity for restraint in cases who show any tendency to excitement. The patient, an old man seldom disturbed, removed the bandages from his eyes and infected one of them before his act was discovered. Iritis and corneal opacity was the result. In another case the lens was found calcareous and could not be removed. In addition to the cataract patients three cases of pterygium, two of dacryo-cystitis, one of strabismus and several of entropion were surgically treated with good results.

Operations upon the Male Genito-Urinary System.—Many patients, particularly chronic cases, suffer much discomfort from urethral strictures of long standing. Whenever the stricture greatly reduces the calibre of the urethra, causes occasional retention, or discomfort in urinating, its location should be ascertained and, if possible, internal urethrotomy performed.

An examination of several hundred male patients reveals the fact that phimosis is exceedingly common,

particularly in idiots and imbeciles. Sollier emphasizes the necessity for circumcision in the congenitally deficient as the irritation is a frequent cause of masturbation. The latter habit may undoubtedly be induced in cases other than the congenitally deficient by the irritation of secretions confined within the prepuce. In neurasthenics the reflex irritation may be a prolific cause of excessively frequent nocturnal emissions. To remove these reflex excitations and promote cleanliness, circumcision should be performed in all cases in which the prepuce can not be retracted over the glans. The so-called test-tube method is preferable and can be carried out quickly and painlessly with the local use of cocaine.* During the past year the operation has been performed several times in this hospital with excellent results. Following this operation surgical restraint will be necessary for a few days in all but convalescent cases.

Varicocele is common among the insane and should be treated by the cautery or excision. Hydrocele, in my experience, is not common among the insane, though I do not know why it should not be found as often as among the sane. When present, a radical cure should be attempted. If an acute case, his residence in the hospital for a few months may be the only opportunity he will encounter for permanent relief. In the senile dementias prostatic hypertrophy is extremely frequent. As the great majority of cases occur in the chronic senile insane, emasculation by resection of the vas deferens or castration can not be objectionable. (One case treated by resection over a year ago has not had recourse to the catheter since the operation, whereas, formerly it was necessary to use it frequently. In many cases the operation can be performed without general anæsthesia. Cocaine or Schleich's infiltration anæsthesia can be used.

Vesical or renal calculi, sarcoma or tuberculosis of the testes and cystitis, should be surgically treated promptly. In the insane no special indications are presented by these

* See Medical Record, March 23, 1895, p. 381.

diseases. It should be mentioned, however, that frequently, owing to the excitement of the patient or non-dependence on subjective symptoms, vesical calculi may be overlooked.

Genito-Urinary Surgery: Female.—Here the indications for elective operations in the sane should be met in the insane. If the pathological condition present has anything more than conjectural relation to the mental disorder, surgical relief is imperatively called for. It is my good fortune to be personally familiar with the work of Rohé in this line.* Observation of his results and experience since gained lead me to believe that the causative relation of pelvic disease to insanity in women is of greater moment than is generally acknowledged. I mention this fact, which to some may appear foreign to my subject, as oöphorectomy, hysterectomy, etc., are often elective operations. I have seen several cases of prolonged insanity due reflexly to ovarian or uterine diseases recover or improve in the hands of the above-mentioned operator, where the pathological condition of the parts removed clearly justified the procedure even though the patient had not mentally improved. In periodic cases with outbursts of mania at the catamenia, oöphorectomy should be considered imperative and not elective. In chronic cases, uterine or ovarian tumors and cysts should be removed without hesitancy, particularly if they appear to have deleterious influence on the general health of the patient. Perineoplasty is indicated in cases of perineal laceration sufficient to damage the integrity of the pelvic floor. Vesical or recto-vaginal fistula, prolapsus uteri, uterine polypi or cervical laceration all call for the usual surgical treatment.

Miscellaneous Elective Surgery.—Amputation may occasionally be an elective operation, particularly of the minor extremities. Surgical measures may be considered

* Rohé: Jour. Amer. Med. Assoc., Sept. 24, 1892, and Oct. 12, 1895; Med. and Surg. Reporter, Jan. 27, 1894; N. Y. Med. Jour., Oct. 14, 1893.

See also Wylie: Med. Rec., Aug. 14, 1894; Manton: Amer. Gyn. Jour., Jan. and June, 1893.

for sloughing ulcers, slow gangrene, mal-union of fractures, malignant or large benign tumors and osteal tuberculosis. On account of the frequency of osteal accidents in the insane, many cases of unreduced fracture or dislocation will be found among the chronic cases, which can be profitably treated by resection. In young patients it is permissible to consider the surgical relief of extreme cases of genu valgum or varum. During the year mentioned several of the above-mentioned operations have been performed with results sufficient to encourage a continuance of reparative surgical work.

In cases of epilepsy or insanity with depressed fracture where the history shows a relationship between the accident and the mental disorder, trephining should be carried out even though many years have elapsed. Removal of the depressed plate, breaking up of dural adhesions and the relief of abnormal cerebral pressure, if present, may reduce the convulsions in number or intensity or beneficially influence the mental health.* In recent cases of traumatism and in focal or Jacksonian epilepsy the operation should be considered obligatory and not elective.

Owing to the prevalence of constipation, hæmorrhoids are exceedingly common among the insane, particularly in cases of melancholia and dementia. Nothing is more frequently overlooked, as these patients will seldom call attention to their hæmorrhoids, no matter how troublesome. During the preliminary examination following admission every patient should be examined for rectal disease. Rectal prolapse and fistula are relatively common. Through neglect or ignorance many of these cases are greatly aggravated. Benign growths if deforming, unusually large or troublesome, demand attention. Almost any State hospital which has the usual quota of chronic cases could supply any surgeon's clinic for weeks with a variety of benign, semi-malignant or malignant tumors. In suspected cases, nasal polypi should be searched for and removed. Tertiary syphilitic lesions sometimes call

* See American Journal of Insanity, October, 1892, p. 222.

for operative interference. Muscular contractures should have attention and the case studied with a view to relief. Contractions of the palmar fascia, the different forms of talipes or more frequently torticollis, can usually be benefited.

Reparative or Plastic Operations upon the Soft Parts.—In this line of surgical work the personal appearance or comfort of the patient forms the incentive. The placid mentality of a low grade imbecile may not be aroused to appreciate the results of an operation upon his hare-lip, nor is the tenure of his life lengthened thereby, but the thanks of his relatives or appreciative associates is obtained, his personal appearance improved and some experience, more or less valuable to the operator, gained. Skin-grafting should be often resorted to in our State hospitals where ulcers of large area, burn cicatrices, etc., are common. Reverdin's or Thiersch's method may be used according to the circumstances of the case. Staphylorrhaphy and rhinoplasty should be considered when the palate or nose admits of such reparative work.

My only desire in thus briefly and superficially alluding to the elective and semi-elective surgical operations, is to call attention to the fact that the insane, as a class, are not given, in our State hospitals, the free advantage of modern surgical methods. In due time, I believe this criticism will no longer hold good. When that time comes, let us see that we do not go to the opposite extreme and bring reproach upon our work by unnecessary use of the knife. In the meantime, it is our plain duty to see that none of our patients suffer long from remediable surgical disorders, such as detailed above, solely on the ground that we are alienists, not surgeons. While we are watching the evolution of a paranoiac or the dissolution of a paretic, let our specialism be broad enough to comprehend and treat, surgically if necessary, a hare-lip, a hernia or a torticollis.

AN UNUSUAL CASE OF CEREBRAL TUMOR.

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CASE No. 7463.—B. M., admitted June 13, 1896. Man, age 71 years, married. Has had six children. Occupation, carpenter. Born in New Jersey, as were both parents. Insane relations or inheritance denied. Habits of patient good.

History prior to admission.—About four years before admission patient fell from the top of a building and sustained a severe injury to the left side of the head near the top. A severe scalp wound resulted and it required eleven sutures to close it; he remained unconscious for three days. Following this he had four convulsive attacks, the last occurring eight months before admission. After the fall he became irritable and depressed. He threatened to commit suicide and gradually grew demented. Became exacting, melancholic, disinclined to talk and complained of great bodily discomfort. Threatened to kill himself at night by cutting his throat. Grew untidy in habits and soiled his clothing. At times he was angry at his little grandchildren and pushed them about. He changed in character and disposition as shown by jealousy towards wife and his having locked the door and refused to admit his family. Said they were against him. The family reported that he "eats butter by the dish-ful, believing it bread and does not know the taste." He would put his hat on the stove. His movements and speech became incoordinate, and his family said that when he was excited his speech was thick. Memory failed and he recently wanted to sell his house for five dollars.

The hesitancy and thickness of speech were first noticed a short time after the fall and injury to head. Patient had occasional attacks of vertigo and following them the mental symptoms were more marked. A sore on the glans penis, which was thought to be a cancer, was first noticed about two years prior to his admission to the hospital; this was after the mental symptoms were noticed. His general condition did not seem to warrant an operation on the penis.

On admission.—Was feeble physically, weight 135 lbs., height 5 feet 3 inches; pulse 99 and feeble; tongue coated; pupils normal; gait unsteady, and this seemed due to his general weakness; bowels loose; heart and lungs normal; anæmic and cachetic.

Had an epithelioma of penis. Most of glans penis was eaten away, the corpora indurated and enlarged. Inguinal glands were much indurated and enlarged. End of penis was granular, suppurated and bled easily. Patient said that this condition had existed a year or more; also said, "Worst trouble I had was a place cut in there," pointing to penis. "I can't talk very well." "I do not remember

whole tumor in larger and coarser interlacing bands is a moderate amount of fibrillar connective tissue bundles.

Microscopical Examination of the Tumor of the Penis.—Anatomical diagnosis—epithelioma. It is composed of anastomosing series of plugs and strands of epithelial cells in various stages of growth and development. Such cells are very frequently gathered together in concentric groups of epithelial pearls. The remaining portion of the tumor is occupied by tissue resembling in structure granulation tissue. The sections are taken in such planes as to make it impossible to determine whether these strands and plugs are continuous with the rete Malpighii of the skin.

REMARKS.—It is interesting to note that the cerebral tumor seemed to grow from the dura and had its origin probably either from the dura or pia, perhaps being caused by a meningitis which resulted after the injury to head received four years before admission.

The aphasia manifested, up to the time of the hemorrhage which took place thirty-six hours before death, seemed to involve especially the naming centre, being a forgetfulness of certain words which patient desired to use.

Mills* reports a case of tumor involving the third temporal convolution of the left hemisphere in which patient said "yes," or "no," properly, and in many ways indicated that she knew what objects were and their use but could not give their names.

Magnum† reported a case of softening of the anterior half of the second temporal convolution of the right side which extended inferiorly to the middle of the third temporal. Patient showed an inability to call common objects about him by their names.

Our case shows little of the common symptoms of cerebral tumor, *i. e.*, headache, vertigo, etc., and notwithstanding the large size of the tumor no motor symptoms were apparent. An involvement of the special senses of taste and smell was mentioned in the history of the patient. It would have been very easy to have overlooked the aphasic symptoms in the dementia which tended to mask them.

*Chas. K. Mills in "Nervous Diseases by American Authors" edited by F. X. Dercum, page 427.

†Magnum on Aphasia. In "Brain," April 1870, page 116.

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FIG. '1.



A. Part of Tumor which was removed with the Calvarium B. Part of Tumor which was left in the Brain. C. Cavity from which the Tumor was enucleated

MANN AND STRANAHAN: AN UNUSUAL CASE OF CEREBRAL TUMOR.

THE INDIVIDUALITY OF THE CELL. (ABSTRACT).

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WITH AN INTRODUCTION BY DR. VAN GIESON.

It is a felicitous privilege to have the opportunity of basing a plea for the more comprehensive introduction of biological science into medical investigation and especially the application of modern cellular biology to the problems of pathology upon such fundamental conceptions in cell science as are brought up in Dr. Graf's discussion of the individuality of the cell. While such a plea is not at all new, especially that of the application of cytology to pathology, yet it may be presented from time to time more emphatically with new arguments of a more important character.

Recent investigations seem to indicate that the science of modern cytology will prove to be an inexhaustible mine of valuable discoveries in the extensive *terra incognita* of pathology. Up to the present time it was not possible to attain any comprehensive and rational application of cytology to pathology, for both sciences had to travel a certain distance along the pathway of evolution before they could be conjoined to a common aim in seeking the causes and nature of disease.

The elementary truths of pathology had to be recorded before it might engage the services of cytology and the widely spread facts of cytology had to be joined together into a coherent whole before they in turn might serve the aims and ends of pathology. Thus in great measure the two sciences have been traveling along independently for some eighty years but the time has arrived when they may become intimately correlated in the investigation of disease, and be of mutual benefit.

The future progress of human and animal pathology

will be largely due to the study of cellular biology, linked with physiology and physiological chemistry.

The investigation of morbid anatomy from the standpoint of topographical pathological anatomy has served its purpose in laying the foundations of our knowledge of disease processes. In the evolution of our understanding of morbid changes in the body in connection with various diseases the naked eye inspection of lesions at the autopsy table came first; then with increasing perfection of the microscope and its methods of technical research a more penetrating scrutiny into the changes in the body wrought by disease became possible and the further observation and discrimination of the association and distribution of changes in different diseases were recorded.

In the past eighty years of application of the microscope to the investigation of the physical basis of disease the pathologist has directed his studies to the more obtrusive grosser and coarser topographical changes involving whole groups and communities of cells rather than toward the cells as individuals, and at the present time investigation of changes in the body from this standpoint has well nigh reached its limitations to be succeeded by the application of cytology to morbid processes. This, correlated with physiological chemistry, will constitute the next epoch in the progress of pathology and unlock vast stores of knowledge of disease, especially the great host of illnesses which still seem subtle and without physical traces on the body, such as the apparently mysterious infirmities that befall the delicate and sensitive mechanism of the mind.

Such studies of the coarser, grosser and topographical changes in the tissues have been productive of enormous advances in the understanding of the relation of morbid changes in the body to a great many forms of disease and have brought to light the several phases or varieties of abnormal processes which at present are to such a large extent so clearly understood as being due to the action of toxic substances in one form or another.

These studies have elicited in a very large degree the

nature of the varieties and even the interpretation of the phases of the several great fundamental pathological processes such as degeneration, necrosis, inflammation and tumors and much of the relationship of these processes and their variations to the protean symptomatology and varieties of disease. A herculean amount of literature of the more objective changes due to disease has been recorded so that we are well acquainted with, and know what to expect to find in the coarser and more advanced traces in the tissues of a great number of the more important frequent and grave diseases.

Yet it must be confessed that while the study of pathology in the course of its development has recorded to such a great extent the coarser and grosser lesions obtrusive by their extent and distribution or by their obvious signs of changing, distorting or destroying whole masses of cells, it has failed to grasp the *essence* and *beginnings* of morbid processes, and left a multitude of diseases unexplained.

This is so because the scope of topographical pathology investigated stages of morbid processes in their advanced or terminal stages; it recognized the effects rather than the cause of disease.

In studying the morphological traces of disease we have naturally worked gradually backward from the more obvious, extreme, and terminal results of morbid changes toward the very beginning of these changes which lie in the marvelous microcosm of the cell and are forthcoming only through the scrutiny of the great modern science of cytology.

Thus the older topographical scope of pathology has served its purpose and cleared the way for the introduction of cyto-pathology; forasmuch as disease in general is due to perverted or changed cell chemistry it is easy to understand that a world of changes may take place in the complex and wonderful internal mechanism of the cell and yet be beyond the inquisition of the microscope when used with the methods and conception of topographical pathology.

Such fine, exceedingly delicate changes in the internal organization of the body cells may not necessarily change their outward form or be destructive; in fact to a marvelous extent these structural cellular changes in disease are compatible with restoration in both function and organization of the cell.

We must understand and put into practical operation the fact that alterations in the outward form and shape of the cell are no criterion of internal cellular lesions and leave us in entire ignorance of the great number of changes which occur in the internal cell organization in disease. In advance of the coarser and grosser signs of cell destruction are a multitude of antecedent changes in no wise manifested by such palpable signs as losses of the cell substance. Yet it may be justly said that to a large extent such were the signs—coarse, destructive changes in the outward form or in the substance of the cell—by which with the old-fashioned methods of topographical pathology we judged of modifications in the complicated internal cell mechanism in disease.

Such minute subtle changes in the cells showing so beautifully the handiwork of toxic substances in the production of diseases are, although they have been beyond the ken of topographical pathology, just as significant in the production of the symptoms of disease as the coarser, grosser and more evident changes in the whole masses and communities of cells. For the cell instead of being a homogeneous mass of protoplasm, as it seemed in the earlier days of evolution of the knowledge of cytology, has highly differentiated parts, and possesses the power by beautiful adaptations of its constituent element of adjusting itself to the manifest requirements of a varied life and to the changes in the environment. The cell possesses organs so well fitted to carry on its life functions and to perform its offices in the physiological division of labor that it is not inapt to compare these cellular organs in a measure to the organs of the body itself. These cell organs have their functions, and hence the changes wrought on them

by toxic substances so largely the causes of diseases interfere with the duties of the cell in the allotment of physiological labor and manifest symptoms of disease.

Nowhere is this more true than in the cells of the nervous system. Practically what has been done for the last fifty years has been to overlook and entirely ignore changes going on in the interior of the ganglion cells and to call them normal, because their *external contour, shape* and *form* were not interfered with in the vast and varied number of nervous and mental diseases due to toxic agents which produce subtile but none the less greatly significant changes in the internal organization of the ganglion cell.

It is not strange then that topographical pathology has failed to render any suitable account of a great host of diseases which leave no gross changes upon the organs and tissues, or of the beginning phases of disease in general which do not essentially modify the contours and external morphology of the individual cells of the body. And yet the symptoms of these diseases are expressed parallel with changes in the cellular microcosm which may leave no outward mark upon the cell and are compatible with recovery of both structure and function of the cell. It is not untoward that a great number of diseases still remain unexplained at the present day from the standpoint of a morphological basis, for in the eyes of topographical pathology they appear to be diseases *sine materia*.

Defects of the older methods of pathological anatomy are nowhere more glaring than in its futile attempts to render an account of the diseases of the mind and any thorough explanation of a very large share of nervous diseases. It has failed also to present much information in the solution of such problems for instance as the relation of morphological changes to the phenomena of fever, to the delirium of acute toxic diseases, the traces of auto-intoxication, epilepsy, chorea, etc. The seeming barrier which mental diseases in almost their entirety as a group presented to the inquisition of pathological investigation is especially emphatic.

Consider for example all the shortcomings of the older conceptions of work in pathology as against the clear light which cyto-pathology throws upon the morphological basis which explains so well the symptoms of rabies, or the acute toxic forms of ordinary delirium. Until within a very short time this disease and the symptoms of such a common thing as delirium with their dramatic involvement of the nervous system seemed without explanation from the apparent absence of changes in the neural axis. So long as the nervous system in such instances was preserved with Müller's fluid and stained with carmine and the like, the cells were present, maintained their normal contour, and even their nuclei. They appeared homogeneous and just the same as cells in the normal nervous system, because in both cases only the outward form of the cells was preserved but the world of structures within the cell was ruined.

What an enormous mass of vitally significant facts was concealed by such methods of examination of the nervous system!

Such methods fail to show us the wonderfully differentiated internal structures of the ganglion cell both in the normal condition and in its changed mechanisms in disease. And as is the case with rabies and the familiar delirium of the acute general somatic diseases, so it is with a multitude of serious, common every-day diseases and above all with the diseases of the nervous system.

The very heart of the problem of explaining the pathology of mental and nervous diseases lies in the study of the interior organization of the ganglion cell, provided always that such study does not forget to correlate the nervous system with other much more humbly constructed parts of the body. For the body is an organic and coherent whole and the brain obeys the great fundamental laws of pathological processes like other simpler parts of the body where the operation of these laws may be more readily understood.

So much, then, in the future is to be accomplished in the elucidation of many of these diseases, seeming at the pres-

ent to be without morphological traces, that many reasons may be brought forward in favor of the application of cytopathology which will doubtless appear superfluous in the future when cytopathology has come into more general use, not only as a scientific theory but in practical operation at the laboratory table.

But by the application of cytology to the problems of pathology, it is not to be understood that the mere structure and morphology of diseased cells are to be studied, for this could not give us the ultimate explanation of disease any more than could the science of pathology itself working single-handed without the correlation of physiology, toxicology and a number of other related sciences.

It is a comparatively simple task to describe the physical properties and changes in the interior of cells, but it is quite another thing to give the interpretation, meaning and significance of these changes with respect to disease and symptomatology. This can only be accomplished by studying morphological cytological changes hand in hand with the physiology, the chemistry, the statics, dynamics, and evolution of the cell.

It would be a sententious truism to intimate that in all these years of the development of our knowledge of pathological anatomy the necessity of a deep insight into the interior of the cell in the study of disease processes was not thoroughly recognized.

Over two score of years ago the great founder of modern pathology in his books on "Cellular Pathology" made the science of the cell the very cornerstone of pathology and presaged fundamental truths in cytology with a depth which we are now only beginning to comprehend.

In the study of parenchymatous degeneration of the viscera the pathologist under his former conceptions has attempted and forecast the application of modern cytology to his problems. But even these studies of degeneration of the parenchyma cells have presented a comparatively crude and superficial description of the more advanced and terminal stages approaching toward the more objective

signs of necrosis. It must be admitted that the pathologist until very recently has rendered a very meagre tithe of facts and interpretations of the whole account of cellular degeneration.

The ultimate study of these acute or chronic degenerations of the parenchyma cells transferred from the lanterns of the older scope of pathology to the search light of cytology will be of enormous importance in illuminating the cause of disease. For these parenchymatous degenerations, whether acute or chronic, are expressions of chemical reactions between toxic substances or their equivalents on the one hand and the constituents of the cell on the other. And when cytologic investigation has furnished the complete record of these cellular degenerations we shall have the corresponding history of the traces from the very beginning of the action on the body-cells of toxic substances which are so largely the cause of disease.

It may be understood also more definitely how these varied chemical stimuli included under the very comprehensive use of the term toxic agencies, exciting, depressing, or abrogating either transiently or permanently the functions of the cells in various stages of parenchymatous degeneration, are parallel with the manifestations of the symptoms.

Nowhere else in the body are the symptomatic equivalents of the various phases of toxic cellular reactions so plainly manifested as in parenchymatous degeneration of the nervous system. This form of degeneration, I believe, embodies the most fundamental truths of the nature of a very large share of mental and nervous diseases.

The stages of acute and chronic parenchymatous degeneration of the nervous system run in such a definite parallelism to the symptoms of mental and nervous diseases that I have previously attempted to show with more detail the importance of particularizing the phases of this form of degeneration under the divisions of cell resolution, cell restoration and cell destruction. It is important to recognize, especially in the nervous system, these phases

of parenchymatous degeneration controlled by the variable factors of the body forces on the one hand, and those of the poisons on the other, for they govern the whole course of the very extensive forms of disease associated with parenchymatous degenerations of the nervous system.

Following in the wake of the destructive outcome of parenchymatous degeneration, more particularly the chronic form, are secondary adjustments of the tissues surrounding the destroyed cells. These more obtrusive secondary results of parenchymatous degeneration were readily grasped by the pathologist of former days, while the primary and essential phase of the disease was more or less ignored. Hence the unsatisfactory and conflicting explanations of many chronic diseases, the preliminary chronic toxic degeneration of the parenchyma cells not being understood.

Erroneous views have prevailed especially in regard to many forms of subacute or chronic nervous diseases with degenerations of fibre tracts because the lesions were regarded only from the restricted standpoint of the more obtrusive phenomena entirely secondary to the unobserved primary lesion of *chronic toxic cytolysis* or destruction of the parenchyma cells.

For instance, in tabes dorsalis, I have been able in several cases to demonstrate to my own satisfaction at least, that *the real cause of the disease is a chronic toxic cytolysis of the posterior spinal ganglion system*, and that the lesion in the posterior columns of the cord is merely a secondary productive or "adaptive" (Welch) adjustment of the neuroglia to fill up the gap caused by the death of axones of the destroyed spinal ganglion cells.

Similar cytologic examinations of a number of cases of peripheral neuritis convince me that the "neuritis" is merely a secondary degeneration devolving upon fibres issuing from anterior horn cells *primarily* diseased by toxic parenchymatous degeneration. This primary cause of the "neuritis" could not be recognized by the quite

universal preservation of the spinal cord formerly practised by Müller's fluid.

These two examples above urge again the necessity of studying disease with the conception of modern cellular biology and the wisdom of including departments of biology in pathological laboratories to bridge medicine over into biology, and pathology into the domain of cytology.

It seems to me, with one or two exceptions, notably in the recent study of tumors, that the attitude of the pathologist in attempting to penetrate into the inmost nature of the cell structure is somewhat like one would know the things and events within a wonderful cathedral by viewing it from afar.

These deficiencies of pathology in morbid cell anatomy, as intimated before, are perfectly natural, and not until the progress of the present time in cytology and pathology was reached could they be linked together to investigate the problems of the causation of disease.

Hence the application of Virchow's great conceptions of "cellular pathology," or as we might perhaps to-day call it by names not as good, such as pathological-cytology or cyto-pathology, was deferred nearly forty years.

If anyone unmindful of how much more complicated than even the planets are these tiny cellular microcosms, should choose to think that the shortcomings of the good intentions in cell work of the older pathology have been sentimentiously dealt with here, he might do well to consider how like an unwritten tablet is the book of changes beside the infirmities of the most wonderful thing in the universe—the mind.

Among Maudsley's noble sentences we find: "Knowledge is but a little gleam of light between two infinities of ignorance, the infinitely little and the infinitely great." Among the infinitely little things is the cell, and while perhaps not in complete ignorance we have much to learn about it.

Yet, if we would apply cytology to the problems of pathology, it will not be sufficient to accomplish broad, comprehensive work in merely using the bald methods of

investigation of this science. To interpret the gains from the use of this science we must have some philosophical notion of the theory of the cell; the relation of cells to each other; the evolution of cells; their individuality; their relations to the whole body; their functions; the manner in which they have evolved their functions; their allotment in the physiological apportionment of labor and other problems; in short, some conceptions of the doctrine of cells as a science. And inasmuch as the whole change in the attitude of pathological investigation resolves itself into the study of *cells as individuals*, rather than as communities, what is embodied in the title of Dr. Graf's paper is opportune to the pathologist as well as the biologist.

This paper, containing a report of the writer's views compared with those of other authors regarding the cellular theory is, to a large extent, the outcome of my investigations upon cytology of the leeches during the years 1894 and 1895. The present article is of a preliminary and aphoristic character as I trust to have the privilege within a short time of publishing a more detailed account of these views.

The cellular theory as established by Schleiden and Schwann (1838 and 1839) has been universally accepted by the naturalists and only from time to time slight protests have been ventured against it and alterations have been proposed. Thus in the minds of most of the modern cytologists this theory has gradually been modified, yet until very recently no attempt has been made to substitute for it another doctrine.

During the last few years, however, a new doctrine of organic differentiation has been advocated, especially by Whitman, which is in direct opposition to the cellular theories and we might call this doctrine the *Idioplasm theory*. This doctrine is not quite new for we find a very clear conception of it in the micellar theory of Nägeli, but it is the merit of Whitman to have shown that with the acceptance of the idioplasm theory the cellular theory must fall, as both these theories are diametrically opposed to each other.

We have therefore at the present time to make up our minds which of three different theories about the causes of organic differentiation we have to accept as a working hypothesis. These are:

1. The classical cellular theory of Schleiden and Schwann.

2. A completely revised cellular theory which has not been specially formulated as such, but of which we find the building stones in the works of almost every modern cytologist since Schwann.

3. The idioplasm theory of Nägeli, Weissmann and especially of Whitman.

The attempt of the present paper is to give a formulation of the second of these theories, in which attempt I have to use the ideas of many of the modern cytologists, but have also to rely in some fundamental questions upon original investigation and speculation.

In order to contrast the three theories sharply I shall put their more fundamental postulates into the form of aphorisms.

A.—The classical theory of Schleiden and Schwann:

1. The multi-cellular body is a colony or state of cells.
2. The cell is a unit, an elementary organism.
3. Differentiation is caused by specific adaptation of originally like cells to different external conditions.
4. The body is enabled to perform its work by the principle of the division of labor among the elementary units (Zellenstaat).
5. The cell leads a double life, an independent life on the one hand, and as an integral part of a higher unit on the other.
6. The cell limitations are a specific structure of the cell.
7. Structure is the fundamental principle upon which all the life phenomena are based.
8. Organic growth and regeneration are caused by the fission of the cells as such.
9. The division of cells is caused by overgrowth over a maximum size.

The advocates of the idioplasm theory use in their deductions some expressions and conceptions which are not very lucid as to their meaning. Such terms are, *e. g.*, idioplasm, idiosome and formative power. If I try to explain the significance of these terms I can not vouch that I reproduce the ideas of the inventors of these terms adequately, but as there is no concise definition to be found in their works they leave their unexplained conceptions open to interpretation by others.

Idioplasm is, in the sense of Nägeli and Whitman, a fine network of substance which pervades the whole body of a living being. This network is continuous from one cell to another and stands in its distribution in no fixed relation to the character and shape of the cells.

In Nägeli's view the idioplasmic network is not homogeneous but consists of constituent parts, the micellæ, extremely small bodies of a crystalloid nature (a crystalloid is a crystal which has the faculty of swelling), which are separated bodily by an intra-micellar liquid substance, but held together by physical forces, as molecules are held together in a lifeless substance.

Whitman calls the units of the idioplasma not micellæ but idiosomes, and says nothing with regard to their properties. Both agree in searching for the bearer of life in the idioplasm. Thus Whitman has as well as Nägeli tried to locate the principles of life in a body which is beyond sensual recognition; because the micellæ and the idiosomes are after the view of their inventors so small that they can not be visible with even the best instruments.

Weissmann locates the idioplasm or better identifies the idioplasm with the chromatin (I do not intend to enter here into a discussion as to who was the first to take this view) and his theory has therefore the one advantage that he does not go beyond the realms of invisibility in one point at least. Weissman, of course, has also to assume lesser units in the idioplasm, and his system of biophores, determinants, ids and idants (the first two of which are hypothetical units) is too well known to need explanation here.

The idioplasm theory has not in all its postulates been

clearly formulated by Whitman, but I hope that the following sentences express an adequate idea of his views:

1. The body is an absolute unit. Its constituents, the idiosomes, are not independent units but are integral parts of a whole.

2. The cell is merely a structure, an outward sign of subtle changes in the idioplasmic constitution.

3. With regard to the problem of differentiation I could not get any precise information in the paper of Whitman, but I think a logical answer from his standpoint might be:

Differentiation is localized specialization, is the grouping of idiosomes of like character into areas of increased energy.

This answer, however, would lead us back to the cell standpoint as it is the same thing whether we call a centre of energy an area or a cell.

4. The body is enabled to perform its work by a specific *formative power* of its own.

5. The cell leads no independent life. The actions of the cell are due to the energies of the idiosomes. Life is the formative power of the idioplasm and the cells are only a result of the action of this power.

6. Cell boundaries are of no import. Organic cohesion goes through the whole body.

7. Structure is fundamental, is inherited, and without the presupposition of structure no function can be conceived.

8. Organic growth and regeneration are due to the formative power of the idioplasm.

9. The fission of cells is a secondary phenomenon, is the outward sign of subtle occurrences in the idioplasma.

If we compare these two theories we find that the first is based upon the facts of the formation and division of elementary units, the cells, and that the other is based upon the assumption of a formative power, the seat of which lies in the idioplasma, respectively in the idiosomes.

The theory which I am trying to advocate may be briefly formulated in the following sentences:

1. The body is an association of cells.

2. The cell is a physiological unit, and consists of a large quantity of minute structural elements, which may have the form of granules (microsomes). These microsomes are not all alike, but we must assume a great number of different categories of such, differing by a specific irritability with regard to external stimuli.

Under the influence of specific stimuli, certain of the microsomes grow and divide, while others remain undisturbed and by the *numerical* supremacy of one or more categories of microsomes over the other the specific character of a cell is determined.

The sum total of the energies of these granules, microsomes, or, as I would prefer to call them, biosomes, constitutes the life of the cell. I call them biosomes and not biophores because they ought not to be confounded with Weissmann's biophores, and also because I think the term fits my idea better. In my view they can not be imagined to live separately, they are not *bearers of life*, but elements of a living body.

These biosomes represent an organic association which we call a cell, and they cannot be imagined separated from this association and yet living, as life is a collective conception.

The association of biosomes called a cell, is the ultimate organic unit, as the molecule is the ultimate chemical unit of a specific substance.

The cells are the molecules of the organic body.

3. Differentiation is caused by specific irritation of certain categories of biosomes which gain by rapid growth and multiplication a numerical supremacy over the other biosomes of the cell and thus determine the character of the cell. It is to be supposed that in the germ cell all the biosome categories are in perfect balance, none having any supremacy over the others.

4. The division of labor is, as we see from the preceding speculation, no formative principle or cause but only the effect of specific differentiation. The cause of differentiation might be called the *selection of stimuli* from the side of the cell elements.

5. The proposition that the cell leads a double life is entirely groundless and misleading.

The cell leads only one life, namely, an independent life, that is, it possesses its individual energy.

I maintain a perfect individuality or independence of the cellular life, in opposition to all the cell theories, but, proceeding logically, I can not alter my opinion in any degree.

We can not give a definition of life itself, because we came to the conception of life only by a deduction. Life is the unknown cause of a series of effects which we call life phenomena, *e. g.*, growth, irritability, division, self-determination, etc., etc. We study life by the study of its effects.

In the study of the cell we find that all these phenomena or functions of life may, under favorable conditions, be performed by one single cell as is the case in the protozoons, and in the wandering cells of the metazoon body.

The functions of life can only be exercised under the influence of a stimulus upon living substance, these stimuli pertaining to a class of phenomena which we call forces.

Thus, to recapitulate, we must sharply distinguish:

1. Living substance capable of specific functions.
2. Function (assimilation, growth, sensibility).
3. Stimulus (force, both chemical and physical).

What we call environment is the seat of all the possible stimuli which may call forth the functions of life in the cell.

It has been maintained that there is a fundamental difference between the protozoon and the cell of a metazoon, namely, that the former is independent in its life, and the latter leads a partly independent life, but is to the greater part dependent upon its neighbor cells. It is worth while to investigate this point closer.

Let us suppose that we have an association of cells of different character. Some outside stimulus may instigate a certain cell of that association to grow; the growing cell will press against its neighbors, which possibly may contract or show some other kind of function. It is certain that the structure of the cell association will become altered as soon as any of its elements exhibits changes in structure;

but must we therefore assume two kinds of life? It may be said that the contraction of the one cell is the function of the growth of the other, that therefore the two lives of the two cells are coördinated to a higher unit, a higher life, but this is only apparent.

The contraction of the one cell is not an effect of the growth of the other cell, but it is a function called forth by pressure which is a physical force. Thus the one cell plays here exactly the rôle of an environment with regard to the other cell.

We can not therefore rationally conceive a special life of the body as a unit, but we must regard it as the sum total of the lives of the cells, acting in harmony by the presence of forces, which, similar to the force of gravitation in the universe, bind them together into an apparent unit.

These hypotheses are supported by my observations on cellular structure.

The demonstration of structures like the intracellular musculature and the peripheral organs in the nephridial cells of the leeches, the *gradual* development of which can be traced as going hand in hand with a *gradual* increase of mechanical and chemical stimuli, leaves, at least to myself, no doubt about the adequacy of these views.

There is no preformed structure in these cells, but the elements group themselves into very complex structures under the direct influence of an external stimulus.

6. The limitations of the cells are the expression of the organic cohesion of a system of biosomes associated to form an organic unit. We may, therefore, compare the cells in a rude way to the solar system in which also a number of different elements are held together by the cohesion of the universe (gravitation) and form one unit. There is no wall around it, yet there is a distinct limitation.

7. The so-called axiom "*Function presupposes structure*" (quoted from Whitman), is to my mind illogical. I would directly reverse the statement and say, "*Structure presupposes function.*" We see both in ontogeny and in phylogeny or evolution that by the gradual adaptation to

new functions new structures are evolved. We must never forget that organization is not structure. If the axiom had been put as "Function presupposes organization," I would be perfectly satisfied.

The predetermined factors in the cell are constitution and organization, whereas structure is only formed after the cell is exposed to certain stimuli.

Constitution is the chemical and physical individuality of the cell substance.

Organization expresses the fact that the chemical and physical properties of the substance are not equally distributed through the entire mass, but are bound separately to lesser morphological units, the idiosomes. In the inorganic world constitution would mean the properties of the molecule as a whole; organization would mean that the molecule is built up of atoms possessing different constitutions.

Structure is not predetermined. It is the specific arrangement of elements of like character into groups instigated by external stimulus.

This may also be expressed possibly clearer in the following way:

Structure is the expression of the most direct path along which a specific response must travel in order to meet a specific stimulus.

Examples for this view we find everywhere, but I will select one of the inorganic world as the facts are simpler there.

Water is a substance irritable by alterations in the temperature. An increase in temperature acts as a stimulus to which the water responds by entering the gaseous state of aggregation.

A decrease of temperature is responded to by the water in solidifying.

Solid water (ice) may have very different structures. It may be amorphous, crystalline, granular, and, as in the hailstone, show a structure of concentric shells.

The snowflakes are groups of needle-shaped crystals, which groups present very different shapes. This differ-

ence in shape, which is strictly regulated, depends on the sudden or gradual decrease of temperature and on the intensity of this stimulus.

We assume that the structure of the vapor elements consists of hollow globules.

Is it the presence of predetermined or preformed structures like these mentioned which enables the water to perform its *function* to become solid or *gaseous*? Certainly not. The fact that it becomes solid or gaseous is a function of the water, and that it exercises this function under specific stimuli is due to its constitution and organization. The fact that during the performance of this function a specific structure is formed indicates simply that this structure is a side product caused by the inter-action of function and stimulus.

8. Organic growth and regeneration is due to the growth and division of the idiosomes, which again is caused by the influence of specific stimuli.

The division of the idiosomes may be due to growth. There may exist a law that the stimulated surface of these minute bodies must stand in a fixed relation to the volume of the same.

If these biosomes grow, and the enlargement of the surface does not keep pace with the increase in bulk, a state may be reached in which the surface is too small with regard to the volume of the granule. In that stage the right relation between the size of the surface and the volume can only be re-established by a division of the granule.

9. All division may be due to an overabundance of elementary units or biosomes, and it is effected by an equal distribution and rearrangement of these units into two new systems, a probability towards which most of the recent observations on karyokinesis point.

What the primary impulse for cell division is, is very hard to determine. There may be a fixed relation between stimulated surface and function in the sense that the larger the stimulated surface is the more effective will the function be. The functions again depend upon the

activity of the biosomes, and if the biosomes multiply to such a degree that their bulk becomes too large and that they can not respond quickly enough to stimuli, one part of them must be cast out, a process which we call budding or division, according to the size of the ejected portion.

In conclusion I venture to say a few words about the microsome question. Although we have accumulated a host of facts which prove that microsomes are not artefacts, yet we find in most of the textbooks the existence of normal microsomes treated as an open question.

Wilson in his book on the cell, however, takes a definite standpoint in stating that he believes with certainty that microsomes are not artefacts. It is a great pleasure for me to bring additional and direct evidence for this adequacy of the opinion of Wilson, by observations upon the cytomicrosomes themselves. I have been able to follow the formation of the peripheral organs in the nephridial cell (discovered in the leeches) almost step by step.

In the first stage we find along the inner surface of the cell a greater number of cytomicrosomes than usual, which are neither in size nor in staining affinities different from the other cytomicrosomes. These peripheral microsomes grow and stain darker, and also the cytoplasmic threads by which they are attached to the cell-surface become coarser and stain more intensely, until at last the peripheral microsomes attain a diameter ten times larger than that of the other microsomes and the threads are also extremely coarse. The regular arrangement of these microsomes in one plane parallel with the surface of the cell proves that we have no artefacts in this case.

In the ciliated cell similar instances are found where cytomicrosomes undertake specific functions, but I will report upon these in another paper. I have also been able to demonstrate a specific difference between the cytomicrosomes of different kinds of cells. Thus the microsomes of the smooth muscle cell are about three times larger than those of the nephridial cell. In view of these facts I no longer entertain the least doubt but that the microsomes are normal structures of the cell and not artefacts.

EPILEPSY AND EXPERT TESTIMONY.

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In the course of an editorial examination of the paper following this the opportunity seemed appropriate for discussing in a general way some of the deficiencies of the present methods of scientific investigation of medico-legal problems, particularly with reference to the association of epilepsy with criminal cases.

He who reviews with a critical eye the present course of our medico-legal examinations can not help finding it of the highest moment for the development of science and the progress of society, to make an appeal for a better system of criminal scientific investigation than the one represented by the present methods of medico-legal inquiry.

The whole of this paper is a plea in the interests of Law and Justice.

This paper is divided into the following sections:

- I.—A plea for an organization of scientific medico-legal court procedures.
- II.—General considerations on epilepsy.
- III.—Epilepsy in its relation to responsibility.
- IV.—The medico-legal aspects of the Barbelli case.

I.

A PLEA FOR AN ORGANIZATION OF SCIENTIFIC MEDICO-LEGAL COURT PROCEDURES.

It is certainly of vast importance that the medico-psychiatric profession shall possess a thorough knowledge and aid in the dissemination of a better understanding of all the abnormal mental states and their pathological conditions that may lead directly or indirectly to serious

social transgressions, while it becomes the province of the legal profession to interpret in the light of criminal psychiatry justly and humanely the mass of facts and psychiatric data presented at the trial.

For the protection of society and at the same time to mete out to culprits of the grave transgressions against person sentences which shall be just and rational and not vengeful, it is not alone sufficient to test the case by purely legal forms of practice. The fundamentally important investigation from psychiatric research may bring forth out of the past and present history of the offender unobtrusive facts demonstrating the irresponsibility of the culprit, particularly in the insidious infirmities of the mind, which are entirely beyond the scrutiny of purely legal inquisition. In such a case the irresponsible transgressor should be put under restraint and dependent care of the community, both for his own correction and the protection of society.

It would be a sententious truism to intimate that the correlation of psychiatric and legal investigations in determining the nature of crimes against person, and the character of the punishment or after-care of the culprit are not more or less thoroughly appreciated; but though it be considered a truism, it is more admitted in theory than really carried out in practice. Psychiatric investigation in criminal cases in this State is certainly not exercised with discrimination or under any definite plan, and prompts the question if there is not room for great improvement in *systematizing* trustworthy medico-psychiatric inquiry and advice in our methods of jurisprudence. At present it would be difficult to define the precise conditions under which a given criminal case is to be accorded a scientific psychological, anthropological and medical investigation, because there is no systematized plan of exercising such investigation, or any official body responsible for the intelligent administration of such research into criminal cases.

Unfortunately, under our haphazard methods of juris-

prudence, the element of fortuity largely enters into the settlement of this question, and it is frequently by the merest accident that a thorough, dispassionate and purely scientific investigation is brought to bear on the case.

The present irregular plan and the abuse of scientific investigation in legal cases has not infrequently brought "expert" testimony into disrepute and suspicion even in the eyes of the general public.

It would cost considerable money for the maintenance of a legally appointed commission or some official body to examine criminal cases from the scientific standpoint of psychiatric, pathological, toxicological and anthropological investigations of crime. But the expenditure of such money would be in the long run a great saving and benefit to the State. It is a question if the maintenance of such a commission to act with the court in an advisory capacity and to take charge of scientific investigation in criminal cases, would cost much more than the considerable sums spent under the present irregular methods of conducting "expert" inquiry. In any criminal case where questions of scientific nature arise, the determination of these questions shall fall within the province of the commission, which shall work out the scientific data and *render its general conclusions thereon*, so that the court and jury shall have a solid basis to determine their verdict in connection with the ordinary testimony.

Although in no wise tending to assume any of the prerogatives of the court, such a body might also advise as to the admission of cases for scientific inquiry and prescribe how this should be done in order to dispense with the authority of the dictatorial and *ipse dixit* "science" of "expert" testimony.

Such an official body, best appointed by the State, might undertake the investigation itself or assume the responsibility of its direction and control; in the latter case scientific men would be retained whose career had gained respect in the scientific world and whose publications, investigations and real knowledge of their subjects would make their

researches and opinions authoritative. This would reduce to a minimum the evil of having the second-hand knowledge of would-be "experts" whose shrewdness had gained them a reputation with the laity, that has no knowledge of pathological phenomena. After the commission or official body conducting scientific inquiry in legal cases has directed or undertaken the research, the complete data of such inquiry, together with the general conclusions therefrom, could be submitted in a dispassionate, truth-searching scientific paper as to whether the plea of insanity is right or wrong; such a paper will serve as a guide for the jury or the judge who, under the recommendation of the commission, shall accord to the culprit the measure of punishment, restraint and care the case may demand.

Such documents presented as purely scientific articles unencumbered with the not always strictly pertinent interjections incident to legal discussions would, in the course of time, build up a coherent, definite fund of knowledge of the nature of criminal acts in their true relation to mental alienation.

Besides this such a plan of operation ought to thwart in good measure the more or less successful attempts to excuse criminals who by their own cunning and collusion of others escape their just punishment by masquerading before the jury with ingeniously woven cloaks of insanity. Testimony of this kind under some such system as indicated above would be coldly weighed in the balance and found wanting.

It would be most advantageous that such an official body be appointed by the State, and its duties might tentatively be suggested by the designation of the State Commission of Medico-legal Inquiry. It should consist entirely of scientists and be provided with centralized laboratories of psychological, chemical, toxicological and pathological investigation, together with an appropriate working library pertaining to these fields of inquiry. The relations of this body to like inquiry in the field of coroners' jurisdiction or the establishment of some similar

system to furnish better scientific aid to the coroners' work should also be considered.

Furthermore, the body of scientists, being paid by the State, no matter how the verdict goes, would be free from any preconceived notions often unconsciously formed in the minds of "experts" employed on one or the other side of contending legal forces.

Although probably suggestions of this kind have been presented often enough before and in a better form, but certainly with no keener recognition of their futility, yet even so it is well to keep on urging such opinions until some more favorable time appears.

One good and sensible result of the establishment of such a system could be prophesied with considerable certainty. This would consist in adequate provision for psychiatric study of cases of alleged or real mental irresponsibility during their detention pending the assignment of the trial.

It is simply absurd to detain culprits suspected of having committed a crime in a state of insanity, pending trial, in the ordinary prisons where there is practically no provision whatsoever for scientific surveillance of the case.

A prison physician with a thousand inmates under his charge, even if he had adequate psychiatric training, has no opportunity to watch such a case.

Criminal cases with any probable evidence for a plea of insanity should be detained in some institution like the State hospital for insane criminals under the proper surveillance of trained physicians and attendants. For the testimony of these physicians relative to mental manifestations occurring after the commission of the crime would be reliable and of the utmost value.

Had Maria Barbella, for instance, been detained at an institution of this kind during her incarceration, and had she suffered a subsequent attack of "psychic epilepsy," as the defense had wisely chosen to term her form of mental malady, its nature would have been of the utmost

importance in determining the real character of her crime. Furthermore, the testimony of the epileptic manifestations would be from reliable sources, instead of the untrustworthy lay testimony of her attacks of a disease the knowledge of which is so hazy and ill-defined that it is doubtful if one physician out of ten can grasp at any thorough comprehension of the vagueness of the malady.

II.

GENERAL CONSIDERATIONS ON EPILEPSY.

The present state of criminal examination from a psychiatric standpoint is so defective, so entirely unsatisfactory that a criminal may be cunning enough, under proper instruction, to plead some obscure form of mental alienation which may be corroborated by his friends and their more or less imaginary facts and circumstances.

Of all the infirmities of the mind epilepsy is the most liable to be abused on account of the ambiguity and vagueness of what the thing actually means, since recently there is a tendency of the medical profession to put all kinds of mental derangement and irresistible impulses of assault and homicide under the class of epilepsy and since, furthermore, there is still another tendency to consider that one may be rational and deliberate in planning out his criminal act, carrying it into reality, and yet be in a state of epilepsy of the "psychic" type.

What most of all complicates the question of epilepsy in medical jurisprudence and demands so urgently the most detailed psychiatric examination of the patient is the unobtrusive, evanescent character or even absence of the physical symptoms, the return to a sane condition and the difficulty of comparison with past attacks, and of gaining competent testimony of these past attacks.

But before any further intelligent discussion touching upon the responsibility of epileptics can be presented, we must endeavor to have some definite conception of what epilepsy means, if this be possible in the present state of our knowledge of the disease.

It seems to us that we really understand comparatively little of the forms of epilepsy beyond the distinct type associated with the ordinary form of epileptic fits; that our knowledge of other mental states in this disease is exceedingly vague, hazy and ill-defined, so much so that it is very questionable if many of the psychic states described under the title of epilepsy have ever been really demonstrated as belonging there. Such a vague state of knowledge of the psychic forms of epilepsy does not permit of a strict, precise definition of the term, but in order to minimize a misunderstanding of the use of the term in this preface, we might describe in a general way what we have in mind in speaking of epilepsy.

In reviewing the different types of epilepsy, exclusive of the Jacksonian kind which from the nature of this discussion does not concern us here, we find that, from a descriptive standpoint, they may be classified* under three groups, viz.:

I.—The typical fit epilepsy—which may be divided into

(A) Epilepsy gravior (grand mal).

(B) Epilepsy mitior (petit mal).

II.—The typical fit epilepsy, including both A and B, and associated with intermittent outbreaks of psychic derangement.

III.—Attacks of purely psychic derangement with entire absence of association with fit phenomena of typical epilepsy characteristic of group I.

In the *first group of cases*, in sub-division A, the term is applied to the very definite and characteristic set of manifestations, familiar also to the laity in the phenomena

* The reader must bear in mind that, strictly speaking, epilepsy is nothing but a name covering a complex of various symptoms which may possibly be due to widely different causes. It is therefore simply absurd to forget the starting point and make of a name a causative agency, the activity of which should serve for the explanation of many obscure pathological phenomena. To incarnate epilepsy into some one substantial active cause shows as much good sense as if one, for instance, should make an active entity of the term "paroxysm" and should then ascribe all kinds of sudden onsets of abnormal states to the activity of this "paroxysm agency."

of the epileptic fit, such as loss of consciousness, falling to the ground, the occurrence of tonic and clonic spasms, foaming at the mouth, biting of the tongue, etc.

In sub-division B of the same group, the convulsive motor phenomena of the fit are reduced to a more or less unobtrusive minimum and consist merely of a momentary swaying of the body, grasping at objects to prevent falling from dizziness, transient twitching of some of the facial or other muscles, pallor, etc. There is also a momentary loss of consciousness.*

In this typical form of epilepsy, the attack lasting but a brief time, the patient may to all intents and purposes soon be completely sane and rational. When used to designate such a group of cases the term epilepsy admits of no ambiguity, and primarily the word was used to designate this group of cases exclusively.

In the *second group of cases* the typical fit-like phenomena of both sub-divisions are associated with abnormal psychic states of various degrees of intensity, varying from mental dulness, sluggishness and hebetude up to attacks of fury and destructiveness.

In some cases of the second group, the patient having a fit becomes dull, confused, and sleepy, for a time before returning to his normal condition. In other of these typical cases, but generally after they have occurred for some time, the patient between the fits may be more or less dull, heavy and sluggish, and a particular fit may be followed by an abnormal psychic state of destructive fury in which he may attempt to damage things, persons or himself.

But in still other cases this sequence of a fit followed by a psychic derangement is not so evident. In these cases

* We feel that even in the case of *petit mal* the manifestations cover such a wide range of different phenomena and symptoms, probably belonging to different organic and functional diseases, that one is justified in his hesitation of including them in one group and classing them with typical epilepsy.

The whole subject of *petit mal* is obscure and vague, and needs a radical reconsideration on different and altogether new lines of investigation. But we nevertheless have followed the beaten track of classing *petit mal* with *epilepsia gravior* until a satisfactory scientific investigation of the subject shall appear.

the psychic outburst appears to be altogether independent of, and unaccompanied by, any fit phenomena. The psychic outbreaks are simply interspersed (at more or less infrequent or frequent intervals) among the typical fits.

These interspersed psychic outbursts are termed by the writers on epilepsy the "psychic equivalent of epilepsy," implying that the two are intimately connected and are but manifestations of the same cause.

Sub-divisions A and B in the first two groups merge into each other by a series of gradations and embrace a number of forms which probably comprise the cases described under the term of "imperfect epilepsies."

In the first and second groups the meaning of epilepsy is clear and well defined, because in both of them the fit-like phenomena in greater or less degree are present.

The *third group of cases*, however, is so wide and extensive in its nature that the term epilepsy becomes strained and stretched to such an extent as to lose all definite if not rational meaning.

In this third group of cases called "psychic epilepsy" the patient with the objective signs of the fit entirely absent and with all sorts of gradations in the intensity of semi-consciousness ranging from the lowest to the highest degree commits untoward or violent, unmotivated actions upon things, persons or himself.

So elastic is the term "psychic epilepsy" that it has been made to shelter cases where distinct consciousness and clear recollection of the acts committed are present.

Such instances where the patient could give a detailed description of the acts, knew their nature and consequence, knew right from wrong, have been placed under "psychic epilepsy" simply because the patient declared that during the commission of the act he had not the will or power to refrain from violent, indecent or untoward acts, or because he really was under the dominance of an irresistible impelling power.

In most cases of this third type there is an indistinct, dim state of consciousness of the acts committed in the

seizure. In other infrequent cases, on the other hand, there is distinct consciousness and recollection of the acts performed in the attacks.

In all three groups of cases the pathology or causation of the disease is very obscure, or at least we have nothing to offer in explanation of the conditions except guesses or but poorly substantiated theories.

Besides the theory of Hughlings Jackson of discharge of energy of the higher centres, recently the assumption has been gaining force that the manifestations in many cases of epilepsy of both kinds, motor and psychic, are due to the action of a toxic substance upon the brain which arises within the body and is of evanescent or transient character.

Generally speaking, after the action of this autogenous poison, the brain soon seems to regain its normal structure and function, although after long periods—months and years of the action of this poison—the brain may become more or less permanently damaged.

This theory of the toxic basis of epilepsy might be considered as explaining to some extent the nature of the epileptic attacks. For in the purely typical group of epileptic cases manifested by the phenomena of the fit, the evanescent toxic substance is supposed to act more or less exclusively or preponderantly upon the motor segments of the brain, and hence the uncontrollable, transient convulsions of the fit.

In the “psychic equivalent of epilepsy” characteristic of the second group of cases the toxic agent is assumed to expend its action upon the higher centres of the brain to a greater or less exclusion of the motor segments of the cortex. Hence the phenomena of the fit are absent or reduced to a minimum and are supplanted by unmotivated, irresistible, purposive movements accompanied with different degrees of semi-consciousness.

In connection with this theory the term “psychic equivalent of epilepsy” intimates that the toxic substance omits and passes over the motor segments of the brain to act upon the higher centres.

If this auto-toxic theory of epilepsy be true, it explains how the patients commit their violent or untoward acts in an automatic and reflex fashion. For if a poison act upon the cells of the nervous system, the chemical reaction between the poison and the constituent elements of the cell liberates energy and the manifestation of this potential energy is in no wise within the control of the patient.

But this explanation, defective as it is, applies only to the first two groups and bears no relation whatever to the third group, or "psychic epilepsy," and, moreover, even where the theory can be applied it is only an hypothesis and a supposition, not at all proven or substantiated. Hence, not only are the clinical and psychological sides of epilepsy vague and obscure, but the pathology is equally inadequate for any clear explanation of the nature of the malady.

No theory can be applied to "psychic epilepsy," for "psychic epilepsy" is not at all a scientific concept. A patient with psychic attacks whose general characteristic is a heightened, benevolent, emotional tone will not be classified under epilepsy, unless the attacks are destructive. It is the latter, the homicidal tendencies, the assaults that determine the diagnosis of "psychic epilepsy." Now, from a purely scientific standpoint, the action of a poison on the higher centres does not in the least explain why the psychic manifestations should be dangerous and even destructive to life. A man who should pass all his life with psychic attacks of benevolent character would not be classed as an epileptic. Evidently it is the evil character, the immorality of the act, that determines the diagnosis of "psychic epilepsy." "Psychic epilepsy" is therefore not a scientific, but a teleological concept.

How, then, are we to distinguish whether a whole mass of examples of abnormal psychic states similar to the state characteristic of the third group of epileptic cases is to be included within the nebulous domain of "psychic epilepsy?"

Is a man who commits destructive or criminal acts in an accession of blind fury to be considered as having had an attack of "psychic epilepsy?"

Is the reflex emotional state so highly characteristic of the savage, in which frenzy or blind fury may have a sudden onset productive of destructive acts, assaults, and even murder, to be accounted as "psychic epilepsy?"

The doctrine of psychic epilepsy is weak and rickety. Its very base is rotten. It can not bear the least strain of logical criticism. The method on which the doctrine is based is the one called in logic the method of simple enumeration. It is the method characterized by Bacon as "puerile," and belongs only to the untrained vulgar mind. All prejudices and superstitions are kept up by it; for the vulgar mind, observing that in some instances two things go together, jumps to the conclusion that the two things always go together and that one is the cause of the other, or that both are due to some one mysterious cause.

It is upon this vulgar principle that such superstitions as that Friday is a bad day or that thirteen at the table is an unlucky thing, etc., are accounted for. The vulgar mind can heap up thousands of similar generalizations.

Now, in the doctrine of psychic epilepsy we find the same kind of vulgar reasoning. A typical epileptic attack is in some cases observed by the physician to be followed by some kind of psychical derangement; the physician at once jumps to the conclusion that the two are intimately connected, that one is the cause of the other, or that both of them are due to the same cause. And finally he brings himself to the pass of denominating the psychic derangement, *entirely unconnected* with the typical epileptic attack, as "psychic epilepsy."

Granted even that "psychic epilepsy" means something definite, what it may possibly mean is a sudden onset of blind, destructive fury. But if this be the case, shall we set down any one who commits a crime or an assault in an accession of rage as an epileptic?

Little as we have a right to class abnormal psychical manifestations with epilepsy, even in a case where the latter is present, it is mere logical imbecility to predicate "psychic epilepsy" of abnormal mental states where the typical epileptic attacks have never been observed.

From a purely scientific standpoint, then, we have no right whatsoever to characterize a sudden outburst of destructive fury as epilepsy, because the man had had an attack of typical epilepsy some years previously. The two phenomena are different in kind and we fall into the fallacy of *post hoc ergo propter hoc* if we generalize them and connect and combine them into one. We fall into the error of using the vulgar method of simple enumeration. Now if we are not scientifically justified in calling an abnormal psychic state "psychic epilepsy" merely because some years before a typical motor attack was witnessed, how much more culpable is it to foist a deed that has all of the earmarks of criminal murder (including motive and premeditation) upon "psychic epilepsy" because there is some presumptive evidence to show that the culprit had some sort of typical epileptic manifestations some years before. The Barbella case is a fair example. Furness and Kennon ("The Legal Responsibility in Epilepsy," *STATE HOSPITALS BULLETIN*, Vol. II, No. 1), for instance, in speaking of the case, say:

"During the psychical disturbances there is a tendency to sudden and irresistible impulses usually of a destructive or homicidal nature, frequently being of the most violent and dangerous character without there being any apparent reason or motive, but when a case is presented, as that of Maria Barbella, where, even admitting the presence of epilepsy, reason and motive were clearly shown, and the act premeditated, there immediately arises a doubt in the mind of one familiar with such cases, whether she was mentally irresponsible at the time of the commission of the crime, or whether the crime was due to the vicious tendencies of the race to which she belongs, a people who habitually endeavor to redress their wrongs regardless of their own amenability to the law, being apparently satisfied that they have employed the best means by which justice could obtain."

In the face of all these doubtful aspects of epilepsy we have much difficulty in attaining a clear and distinct con-

ception of "psychic epilepsy" and of understanding why, in the majority of instances, attacks supposed to be characteristic of "psychic epilepsy" should be classed with epilepsy at all. Nor can we see any reason why outbursts of ecstasy, exaltation and buoyancy should not be called "psychic epilepsy," just as well as it is done in the case of attacks with vicious and destructive tendencies.

It would be much better to designate the states that now pass under the ambiguous term of "psychic epilepsy" by the character of the mental state rather than by "psychic epilepsy" until more complete knowledge of the nature of this condition is forthcoming.

III.

EPILEPSY IN ITS RELATION TO RESPONSIBILITY.

All these things go to show that the clinical knowledge of epilepsy is not in a sufficiently advanced condition to afford much aid in determining the truth about the nature of criminal acts, alleged to be associated with the malady. In cases where the plea of epilepsy is used, and criminal acts are alleged to be associated with epileptic attacks, such cases are to be studied for the time being as separate and specialized problems, and then the body of knowledge gained by *purely scientific* investigation of these problems, may be advantageously compared with the more advanced knowledge of the clinical aspect of epilepsy.

In determining the responsibility of epileptics in crime, two points, it seems to us, are of fundamental importance: (1) *comparison with past or future attacks* and (2) *presence or absence of motive*.

In regard to the first factor: The variations in frequency of the attack demand especial emphasis in reference to the determination of responsibility in epileptic acts, for the attacks may occur so rarely and at such long intervals that it may be very difficult to compare the culpable epileptic visitation with previous attacks. They may be, as far as our information goes, years apart. Some epilep-

tics, apparently, may have but few or several attacks in a lifetime, yet one of these may be productive of crime. If reliable testimony is at hand to compare the culpable attack with past attacks, the determination of the question would be comparatively simple were it not for the fact that testimony, trustworthy as to the presence and nature of the past attacks, generally has to be taken from lay rather than medical sources.

If the individual is a confirmed epileptic with the objective phenomena of tolerably frequent fits, it is again not difficult to reach a reliable conclusion. If, on the other hand, the epileptic attacks were of the nature of the "psychic equivalent of epilepsy," the testimony would be of comparatively little value.

If we turn now to the plea of the so-called psychic epilepsy, we find ourselves at once entangled in a jungle of difficulties.

Consider, for instance, the perplexities arising in a seemingly simple case where the very first epileptic visitation that the individual is known to have had may be productive of violence. In the first or second attack the patient ever had, he may suddenly, without any warning or obtrusive signs of a fit, rush forth and injure surrounding objects, persons or himself.

Furness and Kennon, for instance, (*loc. cit.*) cite the case of epilepsy (?) in a man who threw two children one after the other out of a window, fortunately protected by fire escapes, yet during the nine years of his married life there had never been any indications of any epileptic attacks. This man did violence to those who attempted to control him, and was much excited and difficult of control on entering the hospital. He did not have a second attack until six months later. Such a case as this, had this criminal act been successful, would have furnished insurmountable difficulties in eliciting a history of epilepsy, for it was apparently the first attack.

On the other hand, in a case where the jury is inclined to a plausible excuse to exculpate a responsible criminal,

a plea showing that the crime occurred in the midst of the very earliest or first attacks of "psychic epilepsy" ought to work well.

Even if the responsible culprit betrayed consciousness of the act, the plea that he had not the *will or power* to resist the commission of the act, as in "psychic epilepsy," would not be crippled by the legal test of responsibility.

If a murder or like grave crime against person be committed, and the culprit is instructed to claim dominance of an irresistible impulse in committing the act, how shall such a perfectly responsible crime be distinguished from an attack of the so-called "psychic epilepsy?" "Psychic epileptics" attempt and accomplish precisely the same sort of acts.

Apparently the only possible way to demonstrate the responsibility of the crime in such cases would be to restrain the individual under medical supervision, as explained in the first part of this text, with a view to comparison with the occurrence of subsequent attacks.

Concerning the second important point of motive in epileptic responsibility, if the epileptic commits offenses without any motive whatsoever, and has had previous attacks destructive to inanimate objects or to himself, the case is not difficult to decide upon.

If, on the other hand, the act is clothed with design and fits in with strong motive; we ought to be doubtful or excessively cautious in rendering an opinion of irresponsibility.

The nature of epilepsy is such that its visitations permit of no premeditation or design in committing crime nor does it give time and thought for revengeful "epileptics" to get razors out of trunks wherewith to hack a man's throat open to the back-bone, particularly after previously announcing intention of revenge.

Only the fortuity of circumstances could bring the epileptic in the midst of a seizure, occurring so frequently at very long intervals, in contact with the victim whom he or she has a motive for injuring.

In considering the responsibility of epileptics we are at last confronted by the following important questions:

Have we come to such a pass that the Barbella case should become a precedent as to consider that all epileptics who commit legal offenses are to be absolved from responsibility simply because it is established that they have epileptic seizures? Is an epileptic irresponsible because he simply suffers from epileptic attacks?

It must be shown that the epileptic committed the crime in the midst of one of the epileptic visitations to consider him irresponsible.

The salient test of the law, as we understand it, in determining the responsibility of the alleged criminal, is to settle the question whether his mental capacity during the commission of the crime enabled him to distinguish right from wrong, the nature and consequences of his act, and whether he knew that the act he was doing was wrong, and whether he had the will and power to refrain from the act.

It will be observed that this statement of the legal test of responsibility indicates that the fundamental point of inquiry is the condition of the criminal's mind at the time of the commission of the offense. If he had sufficient intelligence to know what he was doing and knew that it was wrong and also the will and power to refrain from the offense, he is, in the contemplation of the law, responsible for the act. Hence we should be careful to have in mind the point that a perfectly sane epileptic might commit a crime and in the turmoil of passion incident thereto become subject to a visitation of the epileptic habit immediately afterward.

Before concluding this section it would be well to clear up one point more—a point perfectly obvious in itself, but which does not seem to be very clear to the “expert,” namely, the relation of amnesia to unconsciousness.

It often occurs in criminal cases that forgetfulness, “oblivion” or amnesia of the criminal act is taken to strengthen the plea of irresponsibility, the reason being that lawyers and “experts” frequently confuse amnesia with unconsciousness. From the fact of amnesia, unconsciousness is inferred, because the two are thought to be identical.

Now we must strongly emphasize the fact, however elementary and trite it may appear to the scientist, that amnesia in no wise implies unconsciousness. The two are not the same. While unconsciousness being a cessation of all psychic activity includes *ipso facto* a lack of memory or amnesia—for there can be no recollection of what did not exist, as a psychic state—amnesia on the other hand (even if it be real) does not necessarily include unconsciousness. The fact that one can not remember what has happened to him does not in the least imply that the past state was an unconscious one. A fall, a blow on the head, may obliterate from memory whole periods of high intellectual activity, but it would certainly be wrong to conclude from the state of amnesia now present that the patient for all that period that had lapsed from his memory was an unconscious automaton. From the mere fact of amnesia or of total “oblivion,” we have no right to infer even a diminished or semi-conscious state. A very high and intense state of consciousness may become dissociated from the rest of conscious life and be incapable of reproduction in the synthesis of memory. The phenomena of double or multiple personality and of post-hypnotic states may serve as good examples. From a psychological standpoint, memory, objectively considered, is a present mental reproduction and recognition of one's past conscious experience, and the loss of the first two conditions, of reproduction and recognition, does not in the least imply the non-existence of that conscious experience. *In short, amnesia is not identical with unconsciousness.*

It is clear, then, that *amnesia can not possibly be made a criterion of criminal irresponsibility.* For the mental state in which the act was committed, though totally forgotten, could have been of an intense nature with the full knowledge of right and wrong and with the power of will of the highest type.

One thing, then, stands out clear and distinct from the whole course of our discussion and that is, the *flimsiness of “Psychic Epilepsy” as an excuse for crime.* From a scien-

tific as well as practical medico-legal standpoint "psychic epilepsy" must not be given any serious consideration on the witness stand. And we sincerely hope that the time is not far off when the encyclopædic "Experts" with their fondling "*Psychic Epilepsy*" will be barred out from our courts of justice.

IV.

THE MEDICO-LEGAL ASPECTS OF THE BARBELLA CASE.

A concrete example may help the reader to realize more fully the practical importance of the views advocated in this paper. The Barbella case serves as an excellent example.

Let us then endeavor to get at the truth of the Barbella affair:

A brief synopsis of the case is as follows: Maria, an ignorant young Italian, twenty-four years old, sincerely loved her seducer, but cut his throat with a razor in one of the wrangles incident to his persistent refusals of her requests of marriage, with which in the two months of their intimacy she had constantly importuned him with the insistence of a woman possessed of this paramount and all-absorbing design.

The woman was not shrewd enough to take pecuniary profit and revenge which the laws and sentiment of the community hold out to women under similar conditions.

Without any thorough inquiry beyond such an aspect of the case, in a trial conducted from a purely legal standpoint, the woman was convicted of murder in the first degree, and sentenced to death.

In the first trial there was a straightforward presentation of a murder with strong motive, which motive the woman herself described rationally soon afterward and the jury seemed unable to find any other interpretation of it.

But, pending the second trial, it appeared to have been apprehended that this interpretation could be strongly modified, probably overthrown, by appealing to the palliative sentiment of the community in such cases under a

sophisticated guise of insanity. This apprehension that the lenient sentiment of the community with female offenders, particularly when the crime grows out of illicit sexual relations, might furnish an avenue of exculpation and even exoneration, seems to have fortified itself with certain points of view which were not at hand to color the testimony in the first trial.

While the woman was awaiting in the prison the execution of the sentence, a desperate effort to save her was made by the defense. An appeal based on legal technicalities of the court procedure was made, the appeal succeeded and a new trial was granted. On the new trial the plea of irresponsibility was insanity—"psychic epilepsy."

In the efforts made to vindicate the woman a whole, unsuspected, highly complicated and well-rounded life history of the culprit, suddenly sprang up—a history that read as smoothly as a novel and which strongly appealed to the emotions of the jury and community. This life history, entirely incompatible with, and contradictory to, the whole course of examination of the first trial, seemed as if suddenly to have arisen in the second trial,—to offer a plea for the presence of "psychic epilepsy" during the commission of the crime.

Such data, apparently furnishing grounds for mental irresponsibility, were of the following nature: It was alleged that there was an absence of the usual premonitory accompaniments of such a deed, and after the commission of the crime the culprit manifested a prolonged dazed condition and an exhibition of a considerable measure of lack of consciousness or at least indications of semi-conscious state.

The woman, it was said, acted in an emotionless, automatic-like way and manifested an "oblivion" of almost everything that had transpired during the act of the crime and immediately afterward for some two hours.

It was claimed that not until some two hours after the crime, and then after having been informed by others of

her transgression, did the woman attempt to respond intelligently to questions, and betray any recollection of what she had done, and even this impression of her deed was evanescent, indistinct and clouded, and her explanation of the act correspondingly imperfect and obscure.

It was alleged that she did not attempt to justify herself, and afterwards claimed to have no recollection of the conversation and adhered to this statement.

In the first trial no excuse was presented and sentence of death was pronounced. In the second trial it appears that a tissue of "psychic epilepsy," ingeniously woven but very flimsy when analyzed by the data in the first trial, allowed the jury to satisfy its conscience in expressing the sentiment of female palliation in a verdict of "not guilty," resulting in acquittal.

The compilations and investigations from legal sources in the paper following this show evidence of neuropathic manifestation in the family history of Maria Barbella, and in so far as the sources of the testimony which furnished the anamnestic data* in that article are to be considered trustworthy there is presumptive evidence of attacks of some kind resembling epilepsy at rare intervals in Maria's past history.

Even if it be granted that these previous attacks may be regarded as having been epileptic in their character, this offers no excuse whatsoever for the commission of a crime.

The subsequent paper does not offer any sort of proof that the crime was committed in the *midst of an epileptic visitation*, nor does it confront the incompatibility of the testimony in the first trial (dead perhaps to subsequent court procedure, but not to science) with the whole story of the epileptic visitations in the commission of the crime.

It might appear, then, that scientific investigation in this particular case had a bad purpose. But if the sentiment

* These are taken in substance from the hypothetical question in the second trial.

of palliating the female criminal has chosen to warp such investigation for its own purposes, this does not militate against our plea for systematized scientific investigation in criminal cases. Even if such scientific investigation be carried out properly under the plan of the tentatively proposed commission, it is very probable that this same sentiment will still be expressed. But it will have fewer opportunities to excuse itself under pretexts and come out more baldly as a subversion of cold reasoning to sentimentalism.

With no proof that the murder was committed in an "epileptic" visitation, it is wrong to acquit the culprit, it is wrong, or rather merely illogical in this particular case, after admitting the irresponsibility of the culprit to set her free upon the community instead of caring for her infirmity in a suitable institution for that purpose; it is wrong again that both of these first two things are set forth as a precedent to stimulate similar and lesser crimes and offenses, particularly in women.

At first glance the inconsistency of how it has happened that the woman is not restrained after her mental irresponsibility is conceded might seem difficult to understand. But it is not a tacit operation of this same sentiment which recognizes the guilt of the woman but feels that her wrongs have outweighed her evil doing.

Such sentiment will, no doubt, continue to operate for a long while, but still one can not help regretting the fact that this sentiment is so sorely exaggerated as to partake of a pathological nature.

In the practical operation of the law in the case of a man, it is not very likely that such a pretense of "psychic epilepsy" or things of that ilk would be entertained seriously in the face of a motive for the deed and such flatly contradictory testimony as was given in the first Barbella trial.

But with women the case is different, there is very much greater danger that the sentiment of this community of exonerating women, will find a plausible excuse for

freeing them from responsible crime, especially when it arises out of affairs mixed up with sexual indulgence.

The evil in opening up new channels in epilepsy for the expression of popular sentiment, in excusing women from grave crimes like murder, exerts its most vicious influence in tacitly encouraging the multitude of adventuresses, female offenders and conspirators, more especially those with a good thick varnish of refinement, to an unrestrained criminal activity in spreading out a net-work of extortion and oppression throughout the community.

In a youthful, inexperienced country, where the social classes are as yet undifferentiated as to status and education, where the dictates of Mammon regulate the course of social relations, where hysterical sentiments and false chivalry form the bane of social life, in such a country as that the female offender thrives and prospers. The laws of our country favor women too much to risk an additional boon of giving her the privilege of exercising the right of execution and persecution of her real or alleged paramours.

Whatever view, however, we may entertain as to the relation of insanity and aberrant mental states to criminal acts, whatever may be our opinion as to "psychic epilepsy" in general and the points brought up in the case of Maria Barbella in particular, one thing must be acknowledged and that is, the trial and its verdict demonstrates to us the absolute necessity of making a complete detailed investigation of criminal cases, of making a complete scientific analysis of the nature of the criminal and the psychic state he was in when the act was carried out. Without such a thorough, delicate examination we are almost sure to go astray in our judgment.

* * *

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The scientific investigator in his studies of medico-legal cases must keep in mind two very important points—

First.—He must endeavor as much as in his power to obtain first-hand, unadulterated testimony by direct examination of the witnesses and accused before any instruction has come in to modify their statements and accounts.

If, however, the *scientific* investigator is unable to obtain such direct testimony, it is of fundamental importance to examine the statements of the witnesses as given in the very first court procedures. In other words, where a second trial was granted on appeal, the testimonies of the first trial in its relation to that of the second are especially valuable for the *scientific* determination of the nature of the case. A disregard of the testimony as given in a first trial is from a *scientific* standpoint absolutely inexcusable, since such an examination loses thereby its inductive validity and *scientific* value.

Second.—The scientific investigator of the relation of mental alienation to responsibility must guard himself against the fallacy so often committed by the untrained vulgar mind, of arguing the wrong point, against the fallacy of *ignoratio elenchi*, as the schools term it. If, for example, the plea of the defense be epilepsy, the major premise is, "Persons committing crimes in an epileptic attack are irresponsible;" it is altogether irrelevant to prove and establish a minor premise: "This crime was committed by an epileptic" and hence conclude fallaciously, "Therefore he or she is irresponsible."

THE MEDICO-LEGAL ASPECT OF THE CASE OF MARIA BARBELLA.*

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PART I.

INTRODUCTORY REMARKS AND ANAMNESTIC DATA OF THE BARBELLA FAMILY.

From the standpoint of responsibility of epileptics in crime, particularly murder, the case of Maria Barbella is a most important one in the annals of criminology.

Maria, an ignorant, wronged woman, kills her seducer, Cataldo. The girl slays the man, whom she loves, apparently in a climax of her mental and probably also physical distress; she slays him suddenly, brutally, in a public place, with an instrument that is uncommon to her hand, with a weapon which the hand itself has to carry and apply to the vital spot in order that an effect should result. There appears to be an absence of the usual premonitory signs of such a deed; the wound inflicted, there follows a series of strange phenomena with the woman who has become a murderess, a series of failures of the normal powers of the body and the brain, which symptoms are followed by a prolonged daze of varying depth; and when consciousness has returned, the slayer manifests an oblivion of almost everything that has transpired since the instant of the greatest acuity of her distress.

An arrest follows the deed, the culprit has made no efforts to escape, no efforts to explain or to excuse anything; she acts in an automatic-like way, shows no emotions, no sentiments. Within two hours after her arrest, the woman, who has heard in the meantime from several individuals of what she has done, talks somewhat, on being

*The Institute does not hold itself responsible for anything advanced in this paper except the anthropological measurements.

questioned, about her crime, and makes some endeavor to explain it, but does not justify herself; afterwards claims not to remember any conversation, and adheres to this statement.

M. is taken to prison. Her conduct is that of a simple, meek, and ignorant person, who is much frightened and afflicted. She expresses much sorrow, but shows no pangs of conscience, no regrets. She becomes exhausted during the trial.

The case before the court is conducted from a purely legal standpoint; the offender is convicted, found guilty of murder in the first degree, and sentenced to be executed.

A second trial is granted on an appeal, and takes place about sixteen months after the first one. In the meantime M. made, under guidance in the prison, some intellectual strides. She is now more instructed, more intelligent, but her behavior never ceased to be that of a simple, mild, affectionate animal or savage; she was generally cheerful, sometimes childish, but did nothing to excess, and was subject to frequent depressions.

The second trial of M. becomes prolonged and elaborate, and is remarkable for the fact that the case is conducted throughout on a medico-legal basis. Almost half a hundred witnesses, including eight medical experts, are summoned to this trial and examined. Maria is claimed to be an abnormal being, who, in the act of the killing of Cataldo, followed unconsciously a morbid, irresistible impulse. The case ends with the culprit's complete acquittal.

Such, in brief, is the history of the case of Maria Barbella.

II.

There is no case of such deep interest to the medical profession, and particularly to the medico-legal branch, as an instance in which a pathological condition of one human being has led directly to such a serious social offense as is the annihilation of a fellow-being.

Murder is one of the gravest resultants of circumstances in society, mainly for the reason that it means an absolute loss and can not be undone, nor even fully compensated for. Due to this importance of murder, it is one of society's greatest interests, and consequently duties, to guard against such a crime and to use every means for its prevention.

The circumstances that may lead to murder are multiple. Society itself is a whole, composed of many interdependent organs, each of which takes prevalently a part in a certain class of social functions. The medical profession is, for instance, one such organ, and the legal profession is another. If we analyze the causes of crime, and those of murder in particular, we will find that we can divide all the causes of such acts into groups, and that different ones of these groups of crime-causes will fall within the function of, or will be of most interest to, different ones of the social organs; and there is one large group of such circumstances or causes of crime, and especially of murder, which falls mainly to the function of the medical social organ, or, briefly, within the scope of medicine.

The last mentioned group of causes comprises all those initiatives to criminal action which are due to some anomalous or pathological conditions of the body or any of its parts, particularly to the latter.

The physician recognizes these underlying anomalous, and especially the pathological, conditions of the human body as the real and original causes of a certain number of transgressions, and as everything concerning imperfections or disorders of the body is relegated to him by society, it becomes the duty of the physician to occupy himself with such conditions and their possible results.

The medical profession is to be the guardian, and at the same time the adviser, of society as far as such conditions are concerned. The medical profession is to protect society from this standpoint. The physician is to demonstrate and make generally known that class of causes of crime which comes within his scope, so that they may be

generally understood, and he is to point out the mode of prevention of these causes, or their treatment when already present, and the proper treatment of the individual in whom they have been already productive of results. And hence every case where anomalous or pathological conditions or combinations of both may be suspected, threaten to become apparent, or have already become manifest, is of the deepest interest to the medical profession for the reason that such conditions may stimulate crime and especially murder.

The most important thing for the medical body under these circumstances is self-evidently to possess a thorough knowledge of all those organic conditions that are or ever may become the indirect or the direct causes of serious social transgressions. Such a knowledge is not yet attained, but is in process of crystallization, and anything that may at any time materially contribute to its progress or clearing up, can not but be of some importance. The best teacher in this case is experience; we learn criminology best from what has already transpired. Our richest information comes from well studied cases in which the causes have already culminated in the effect. And we seem to be confronted with such an instructive instance in the case of Maria.

A close scrutiny reveals in this case an array of pathological and anomalous conditions, the effects of which conditions seem to have stimulated the act of murder. The circumstances are not of any common, well-known type; they have attracted already considerable attention; and these reasons, with the design on my part to fully elucidate the case, call, I think, for an extended publication of the facts discovered in the case.

III.

The facts which are to follow consist of:

(A) A compilation of data taken in substance from the hypothetical question in the second trial, but corroborated

by me in direct examination of various members of the family. (Nothing of importance is included here but what was acceded to by both the defense and the prosecution during the trial.)

(B) The anthropological examinations of the accused, her relatives, etc.; examinations which extended over a period of nearly two months.

(C) A critical consideration of the determined facts, avoiding, however, as much as possible any more than general conclusions.

My rôle in publishing this case should not be looked at as that of a vindicator or defender of M.; my purpose is no other than to present a series of conditions and facts which will prove of not a common criminological interest to the medical profession. Whatever specific conclusions may be drawn from this case are left to the reader.

A.—ANAMNESTIC DATA.*

“*The woman M. was born about twenty-four years ago in Ferrandina, Italy, a town of some 4,000 or 5,000 inhabitants. She was the daughter of poor and illiterate parents.*” (Q.)†

“*M.’s paternal grandfather was a drunkard and a man of a low order of intelligence. He was the only child living out of his family. He often drank to excess. He was a man accustomed to talk unintelligently and irrationally, he would be incoherent and disconnected in his utterances,*

* The anamnestic data are taken, in substance, from the hypothetical question in the second trial.

† Q=Hypothetical question.

W=Witness before court.

NOTE.—Whatever has been taken from the hypothetical question is specified by the quotations marked “Q.” The original language of the hypothetical question has been often slightly modified, but no modifications were made which would have any bearing on the issue of the case. A few particulars of medical interest testified to before the court and not included in the hypothetical question are also incorporated with the following statements, and similarly are indicated by the quotations marked “W.”

and in fact, when spoken to, would seem to have no understanding of what had been said; when told to do this or that, he would do something which was exactly the opposite, this happening in connection with his employment as a tailor, and on other occasions." (Q.)

"M.'s *maternal grandfather* died about forty years ago and during his life was observed on a number of occasions to be seized by fits in the streets (of Ferrandina) when he would rush against persons and attack them and when he was prevented by bystanders from doing violence, then he would wrestle with them and that so long, until he was overpowered and taken into his house. These seizures were observed three or four times at least, although nobody provoked such acts so far as the observers could ascertain. When he had his attacks, he assumed a threatening position, but when he had no attacks, 'then he was a very considerate man and of a severe, earnest appearance.'" (Q.) He was committed to the asylum for the insane at Aversa, and died subsequently in this asylum.

"The *maternal grandmother* of this woman M. had an attack of some kind about a year before her death (which occurred at about the age of 60); this attack occurred during the night-time, and she was found the next morning with her mouth distorted and unable to speak or walk. This condition continued for some two or three months, when she gradually recovered. About a year after the first attack above described, she was seized with a similar one, and after this second attack she lingered for about fifteen days in a condition that was like the condition described above after the first attack, whereupon she died. This maternal grandmother was during her life much addicted to the use of intoxicating liquors, being often in a state of drunkenness." (Q.)

"The *maternal grandfather* had one brother, who was a hunchback." (Q.)

"The *maternal grandmother* had one brother, whose conduct in life was that, when he was intoxicated, he used to smash up the furniture and everything that he could

lay a hand on and threatened also the life of his wife. He was an habitual drunkard and when intoxicated used to throw himself on the ground and turn over like an animal." (Q.)

"The *mother* of M. had one brother, who died at the age of four in convulsions of some kind." (Q.)

"The *father* of M. was one of six or seven children. He had one brother who is now living, who was and probably still is an habitual drunkard. This brother has been in the habit of stripping off his clothes and exposing his nude person in the streets of Ferrandina, and these exhibitions of his person have occurred sometimes when he was drunk and at other times when he was sober. This uncle of M. has been known to enter a saloon, buy liquors for all those around, and then burst into a spasmodic fit of weeping or laughter. He has been seen to crunch the neck of a bottle with his teeth, seemingly because someone had refused to drink with him and this had provoked him. He has on a number of occasions piled up the furniture and other household articles in his home and set fire to them. He would exhibit himself as above described indiscriminately to men, women and children. On one occasion, after having treated all those that happened to be in a saloon, he began to strip off his clothing and had succeeded in removing almost all his garments, when he was prevented from continuing by the bystanders." (Q.) He has been married for over seven years, but never had a child by his wife.

"The *father* of M. had another brother, who died young, under twenty, having been killed by brigands. Another brother had enlisted with Garibaldi as a revolutionist and had thus met his death. Of the sisters of the father of M., one for little or no reason used to strike herself with the fist on the face, pull her own hair, and throw herself on the ground and turn over on the ground and strike her head against the wall." (Q.)

"The *mother* of M. is 47 years old; she was married at the age of 18, she has chronic ophthalmia, which has

troubled her since about her twentieth year. She has headaches and turnings of the head, these latter occasionally so severe that she becomes unable to talk, and has to get hold of something in order to prevent falling to the ground. Her headaches are almost continuous, although at times heavier than at others. A heavy pain commences at the forehead and then goes back and is stronger on the top of the head. When the weather is bad, she suffers the most pain in her head and is unable to work at such times; she has taken medicines, but they have never alleviated her headache trouble. There are moments when her eyes are in utter darkness, with streaks of red and white that flash before them; she sometimes has cramps in the muscle of the right leg, and then a general painful contraction of the right side, up to the neck, which contraction lasts nearly a quarter of an hour or more." (Q.)

"This mother of M. was also troubled up to within a few years ago, with attacks of the following kind: She would fall to the ground, have convulsions, and while muttering would shift her tongue from one corner of her mouth to the other; at such times her eyes would be wide open and she would stretch her arms and legs up and down; her face would be pale when thus seized and she would be stupid when recovering from the attack. When such attacks were approaching, she would often commence to cry and then fall to the ground; during these attacks a bladder filled with snow would be applied to the back of her head but without any apparent effect; and then when she came to again, she felt as if 'she was worth nothing,' and fell into a dazed state." (Q.)

"One day there was a religious procession in Ferrandina. M.'s mother was looking at that procession, when she was suddenly attacked in the manner above described. These seizures came at irregular intervals, sometimes being several months apart, and at other times at much shorter intervals." (Q.)

No serious diseases or injuries in her life, outside the above mentioned.

Her puberty came at about 15, before her marriage, and it was attended with nervousness, headaches and flushes.

Sexual instincts about normal. Marriage from love; immediate conception.

Her left breast became sore after every childbirth, so much so that she never nursed except with the right one.

Knows nothing unusual about herself, save that she was always of a quick temper. Likes to drink but not to excess.

Intolerance of tobacco smoke; had to prohibit smoking by her husband.

Felt several times *tædium vitæ*—prevented from doing herself harm only on account of her love for children and husband.

“The mother of M. during her thirty-one years of married life has had thirteen children and two miscarriages. Of those thirteen children, seven are dead, all dying before the age of two, and of the following diseases: two in convulsions, two in ‘typhoid,’ two of marasmus and one ‘in teething.’”

“The *father* of M. is now about fifty-eight years of age. He was born at Ferrandina, Italy, and was a sort of a vagrant, country musician, later on became a tailor, an employment he still follows.” (Q. and W.)

No particular data about childhood. No schooling; became a musician (through compulsion) at about 15 years, and stayed a wandering musician for a period of years, but was found incapable, left the vocation on this account and became a tailor. Physically, resembles his father. Masturbated considerably when young. Later, fond of women, had chancre once, no consequences. No serious diseases remembered, except pneumonia. “Drank often to excess up to about four years ago” (Q.); had to give up drinking on account of very unpleasant results which followed, and also because of poverty. In character the subject was always quiet, mild, and never did anything dishonest. No sexual abnormalities.

“The *eldest brother* of M. is now 28 years of age; he

was born in Ferrandina, Italy." (Q.) A tailor; lives in wild marriage (for five years) with a woman who separated from her husband. No children. No recollection about early childhood, except that he had scarlatina. School for six years, progress very mediocre. During youth addicted considerably to masturbation. First sexual intercourse with women at about 15; gonorrhoea at 17; intercourse more or less frequent since—retarded by his feeling physically, for he felt bad and sorry, or even disgusted after intercourse.

Repeated attacks of pneumonia at eight, fourteen and seventeen years of age; severe attack of small-pox at the twentieth year. At about six or seven years of age, a glandular swelling appeared on the right side of the neck, and was cut later many times in succession—this seemed to be indicative of scrofula.

"Up to his seventh year the boy was liable to convulsions. When about seven years old, he had, at school, an attack of unconsciousness and a fall. One day, when about twelve years of age, he was attacked by convulsions and fell to the ground and struck himself, so that he was bleeding from the face. When he lay on the floor he was observed to be 'of the color of death' and 'his mouth was all distorted and frothy and he was in a trembling condition;' whilst on the floor, he passed urine in his clothes. After this he was put to bed, sleep supervened for two or three hours. When he awoke and was asked what had happened to him, he said 'I do not know anything. I think I had a turning of the head which caused my accident.'" (Q.) He has had a similar attack about six or seven times since, the last one two months ago. In some of these attacks he fell in the street, in others he fell at home; he has been picked up by the bystanders; no known cause for these attacks; all of them are preceded by vertigo, and followed by a feeling like drunkenness. The unconsciousness is sudden, and the subject will fall on his head, often sustaining injuries. In one of the attacks he injured his left ear, in another his forehead,

(scar just below the insertion of hair and to the left of the median line,) and in the last one his right hand. During several of the attacks he passed urine in his clothes.

He would be free from these severe attacks for one to three years at a time, and between the last and the preceding nearly eight years elapsed; but in these intervals he would often sustain smaller attacks. One or two of these minor attacks occurred several times a month. The minor attacks begin with a frontal, or rarely occipital headache, then comes vertiginous sensation obliging him to catch hold of something; at times this is all, at others the dizziness is followed by a short period of semi-consciousness or even unconsciousness; he would then stop work, but not fall; he had a similar attack yesterday (October 27th). These spells come on him equally well whether at work or at home, but not at night, and are followed by bad feeling in his head—he is as if he were drunk.

“Three or four years ago, this brother of M. felt on one occasion a sudden great heat in his veins and head, and then fell; when he came to, he found himself in bed; he was observed at this time to suddenly fall to the ground, whilst working near a table, and he lay on the ground after falling with his eyes staring; he was ‘stretched out like one dead’ and had grown pale; he lay in this condition for five or six minutes before he came to; water was sprinkled on him seemingly without any effect; he was in a state of stupefaction after coming out of this seizure and was unable to explain what had happened, and could not work for a number of days thereafter.” (Q.)

Since his childhood, the subject has suffered with headaches. These headaches appear once or twice a week, are usually frontal, but seldom occipital. They are always worse in bad weather, and usually worse in the fore part of the day; they are often accompanied by dizziness, and at times by ringing in the right ear; during these headaches his sight is weaker, and his intellect and memory dull; sometimes when suffering much his speech becomes difficult, and occasionally he notices in such a state an unaccountable aversion to those whom he otherwise bears

affection—his family for instance. It is in these headaches that the before-mentioned attacks with unconsciousness develop. And the pains are sometimes so great as to oblige him to leave work. His eyelids will also occasionally twitch in these seizures, and his face is pale.

After recovery from the small-pox, all the above described conditions became aggravated.

The subject is a light sleeper, and has frequently frightening dreams, occasionally of motor character.

He has been accustomed in the past to drink heavily, and still indulges in drink to excess at times, but alcoholic beverages always affect him badly. He can not smoke to any extent, for tobacco also affects him very disagreeably.

The subject is much prone to numbness, often feels hot spots over his body. Sometimes his hands will be as if they were dead, and then he will catch the skin on them with his scissors without being conscious of it.

In character, this first brother of M. is cheerful when fully well; otherwise he is morose, melancholy and irascible.

“The *brother of M. next* to the one just now described, is at present twenty-one years of age. During infancy his legs were weak, so that he could not walk until three years old. As a child he had convulsions, and when about seven or eight years of age, he once suddenly fell on the ground, hurt his head, had his mouth distorted, had to be picked up and cared for. Afterwards he was put upon a bed, slept several hours, and when subsequently asked what had been the matter with him, he was unable to respond intelligently.” (Q.)

He went to school at about the age of six, attended three years, and left because of dislike and being unable to obtain any benefit. Worked since about thirteen years old.

“Has always been troubled with headaches and vertigos.” (Q.) The headaches are always frontal, most marked above the outer orbital angles. They are sometimes so severe as to oblige him to leave work. They are

aggravated regularly by damp weather. Sometimes there is pain in his frontal scar (see lower). The vertigos come sometimes during headache, sometimes without it, but they trouble him particularly at night, when lying down. They are also brought on by anger or provocation. When the headaches are particularly severe, he becomes confused in his mind, and has to hold on to something so as not to fall; he can anticipate these attacks; they come once in a fortnight to once a month, sometimes at day, now and then also at night, are uncontrollable and last but a short while. When such an attack of confusion is about to occur the vertigo increases, he becomes pale, and sees streaks of light, sometimes white, sometimes red; he will catch hold of something for support and then his sight grows obscured and he knows no one and nothing for a brief while. Sometimes his teeth chatter, or some of the muscles contract. He is also cold and stupid when these attacks cease. They are furthermore always accompanied by a strange fear, which sometimes precedes them, but more often follows, and in which he seems to hear footsteps and thinks some one is going to hit him. He has also learned to anticipate these attacks by his head beginning to feel "very weak" and tears rolling from his eyes. When younger, before his fifteenth year, he used to fall in these attacks, and was often injured. "When about eight years old, during a severe attack, he fell and received a deep wound on the forehead over his left eye (a deep cicatrix)." (Q.) As further marks of similar accidents he shows a scar on the tongue and one on the back of his head. These greater attacks were accompanied with complete unconsciousness. When he would arise from them he would feel confused and weak for a time. The last such attack occurred about seven years ago.

"His elder brother declares that once in Italy he went to bed with this boy and that while he (the elder brother) was about to fall asleep, the younger one commenced suddenly to work first with the feet and then with the arms; the elder brother then got up and refreshed him

with water in the face; the boy then became quiet but did not awake; the next morning the boy had no recollection of the occurrence just described." (Q.)

The subject is afflicted with considerable insomnia. At times he is sleepless most of the night, mainly on account of the vertigos. At the time of going to bed he has often ringing in the ears. When asleep, he has fearful dreams and will cry out; he dreams often that he is falling from a high place, or is pursued. Whatever the dream may be, it is never pleasant.

He experiences momentary losses of memory, and psychical absences. There are sudden attacks of anger, sometimes on slight provocation, other times he knows not why. At times he feels tired of life and has suicidal tendencies, but has never tried self-destruction. Often feels like crying, and at times really cries.

The subject is always gloomy and melancholy. He hates to be talked to or to respond. Likes everything, but would not bother anything nor be bothered by it. Thinks he is very unfortunate without knowing exactly why. Has always been stubborn and irascible.

Can smoke but very little—it affects his head; and same with drink—"anything that contains alcohol goes right away to his head" and makes him feel bad. His eyelids twitch some mornings. He also sometimes exhibits contractions in the left leg at night.

Some masturbation. Has sexual relations with women at times, but only rarely, on account of his feeling very bad after. Is not very potent.

About four years ago had pneumonia.

A *still younger brother* of M. is now fourteen years old. Has been at school four years and is in the sixth grammar class (school in Italy as before). Was sent back lately from the sixth to the fifth grammar class. Reading is very hard for him. "This youngest brother of M's suffered with weak legs when a child and when three or four years of age, his legs were put in splints; he wet his bed up to the eighth year. When an infant, he was afflicted with

attacks of 'contortions.' When about two years old, this boy had a convulsion of some kind, when he 'shook with his arms and threw back his head and had his eyes staring and then fell forward.' When about eight years of age, he was playing on a bridge, when suddenly 'stars came into his eyes, he couldn't see any more,' whereupon he fell down; he did not remember what had happened to him until he had been picked up by his comrades and brought home; his face was very pale when he was brought home, he had froth on the mouth and the mouth was slightly distorted and blood flowed from the tongue; he had no recollection of anything happening to him from the time that he first saw the stars until he was brought home." (Q.)

"After each of the two attacks described above, this younger brother of M. was found wet from micturition." (Q.) During one similar attack in Italy the boy fell over a pan of hot coals and sustained a number of burns on his head, yet he lay on the hot coal until removed, afterwards did not know how he came to be burned.

Knows nothing special of himself, except that he suffers often from headaches and vertigos. He "gets a headache all the time," "like wheels going around in his head;" this feeling of dizziness together with headache afflicts him often and he is obliged to hold on to something during these seizures to prevent falling.

The headaches are frontal, and are associated with pallor. The vertigos come mostly in the morning. When severe, he sometimes falls. Fell in this way in Italy about six years ago, hurt his lip, and bit his tongue while unconscious. When falling now, (which is once in two or three months), "makes himself sometimes a lump" on his head, without feeling how. When getting up from his falls, will "think and think how he has fallen, and then will touch himself all around."

Sleep not very good, dreams of thieves coming and trying to kill him; kicks much in sleep (attested by his little sister).

Becomes very angry at times, less so though when younger. Will go on the floor and "stumble" around.

Is afraid in the dark, especially of cats. Says he once saw one with red, fiery eyes which frightened him.

M. has a *sister* now about twenty-three years of age. She is married; a tailoress; born at Ferrandina, Italy. Married three years; has had three children. None of these children are entirely well (husband healthy), particularly the second, who is always sickly. (The youngest child died since of marasmus).

The teething of the two older ones has been accompanied by convulsive seizures. Oldest child, $2\frac{1}{2}$ years old, speaks, but only "like a parrot," repeating only what is said to it.

The young lady had measles and pneumonia—no other diseases in her life. School but one year, left because of dislike. Can not read or write. Puberty at about 14, accompanied with increase of religious sentiments, and with severe headaches, which have continued more or less ever since. She had these headaches in fact at times before puberty, but the memory of them is indistinct. Now, they come two or three times a week, and are worse during menstruation. They are of various degrees of severity, and situated usually over the bregmatic region or whole frontal region, and sometimes extend further. They are always worse in bad weather. Her face becomes mostly pale, but sometimes flushed in the seizures.

With, but also without, these headaches, she has had and still has attacks of vertigo. Such attacks of vertigo come now about once a week, and are also more severe during menstruation. There is no regular time for the vertiginous seizures, though they come mostly in the morning. At times, when she has them she "can not see and has to hold on to something;" but it is that way only "for a minute." "This sister from her childhood up to the age of ten suffered with convulsions. Once in Italy when about fourteen years of age, when engaged in washing with M. at the bank of the river, she had a spell of 'strange

dizziness'—'a turning of the head'—and she fell; after the feeling of dizziness she was unable to see and although she sustained an injury during the fall she knew nothing of what had happened during the attack." (Q.)

"Once when about nine or ten years of age this girl was holding her little brother in her arms, when a dizziness overcame her, her arms loosened, she was unable to see and her little brother fell down; it was more than half an hour before she saw anything; her mother subsequently asked her 'why did you drop the child?' and she said 'I can not remember anything of how it happened, I do not know;' she did not know that the child had fallen until informed of it afterwards." (Q.)

"Four or five years ago, this young lady was on the roof of a house, when all at once she was observed to rush towards the edge of the roof as if she intended to throw herself down; but before she jumped she was seized and carried downstairs; while being carried downstairs, she was unconscious and in slight contortions; in the room those around sprinkled her with water, put vinegar under her nose, freed her of corsets, but she did not come to for some time. After she came to, she remained there stupid, and when asked why she wanted to throw herself from the roof, said she did not know anything about it, that she did not remember, that the last thing she knew was that she became dizzy and saw some flashes of light before her eyes." (Q.)

The subject often feels weak and then sweats much. Her hands are "always hot."

She has momentary spells of unconsciousness, and in such states lets dishes fall and once even dropped a child at her mother's house. These occurrences last but "for five or six seconds;" they come about once a fortnight, with or without headache, and they sometimes appear at more infrequent intervals.

She has frequent twitches of the eyelids, of facial and other muscles. Has chills at times, without any known reason. Now and then (perhaps once in two months),

when having vertigo, all her right side becomes numb; "it feels as if she hadn't the side at all," and she can not work or walk while the sensation lasts, which is usually about ten minutes. Sensations like those of crawling ants on her right lower or upper limb at times. And for all these things she can assign no reason.

Sleep is very light, "naturally so." Dreams very frequently indeed, and the visions are very often of an ugly character. She dreams of falling down and then rising; is taken with great fright, and awakes all sweating; at other times she dreams of bad people or bad animals wanting to have her. Sometimes during sleep she has a feeling like suffocation. She will cry out in her sleep, and is awakened by her husband. On arising feels regularly bad in her head.

She is mostly sad, though for no special reason. At times becomes dejected and weeps, laughs heartily but rarely. Has no bad temper, though she will get angry and swear at times; she likes her home and children and has no serious cause of dissatisfaction, yet most of the time she wishes to die.

Another almost constant sensation is the feeling of fright, and she knows not why. She fears people or some terrible thing pending. Will not go out in the evening, sends her husband instead. Afraid at night even when he is at home. All noises frighten her. And this whole feeling is much stronger at some times than at others.

There are also often feelings of doubt and indecision. She would do something good, but can not bring herself to do it. Feels restrained in different acts, though knowing of no reason.

Drinks moderately—no bad effects, but intolerance of tobacco smoke. Her memory is changeable—not very good.

She is religious, goes to church every morning, to confession every month, and besides this prays at home. She used to be scolded for her excessive church-going when younger and at home, for she would neglect the household duties through it.

The youngest sister of M. is twelve years old, a school girl, and was also born at Ferrandina, Italy.

"The girl had no particular diseases, but when about two years old she started to have convulsive fits, which continued up to about the seventh year; has had no fall since the family left Italy, about four years ago.

The fits had the following character: Without any known cause the girl's eyes would become fixed, she would fall, her body would shake, and she would have a little foam at the mouth." (Q. and W.) The fits would come on from once in several weeks up to two or three times a week, and last two or three minutes. The child was unconscious in the fits, and stupid on arising from them.

"When about three years old, her legs became curved and she had to wear splints." (Q.) The subject remembers nothing distinct about her early childhood. Has attended school four years, is in eighth grammar class, was left twice in a class, does not learn well, "it is too difficult, particularly history."

"Has had headaches and vertigos; had both these for many years, usually together. They come about once in a fortnight or in a month. She will grow pale, suffer much pain in the frontal region (forehead) and her head will turn." (Q.) When having these vertigos, she "will lose her mind and fall" at times, though not often. Will fall in any direction. "Does not feel" if she hurts herself, gets up soon, and can not describe any special after-feeling. Has "fevers" sometimes; they will come mostly at night, though also in daytime, she will awake hot and in a sweat, and has streaks of red light before the eyes for a while.

"Sleep often disturbed by bad dreams, she feels as if she were falling down from a height, and screams also in her sleep." (Q.)

About twice a week experiences "whistling" in the ears, sometimes in left, sometimes in right (no ear disease found). Knows of no cause for this, the noise ceases of its own accord.

Her eyelids twitch sometimes. Hands often tremble, palms sweat.

She "forgets in a moment" at times. Becomes very angry at times and then bites her fingers. Puberty three months ago—no special trouble noticed.

M. herself is about twenty-four years of age.

No accident during gestation, or at delivery. Nursed well. Began to speak later than other children of the family—said nothing but "mamma" and "papa" up to two years. Feet weak up to about five years of age; wetted her bed up to about the same time.

"At the age of about two months, and from then up to three years, convulsions, commencing with a cry, appeared without known reason. At about four years, sat once on father's working table, suddenly fell from it, head first, on the ground, was unconscious, and her eyes turned to one point, staring; she was contorted, had foam and blood around her mouth, and her tongue bled afterwards; was unconscious for about a quarter of an hour, then came out in a stupor and did not become thoroughly awakened for two hours. No cause known for this attack." (Q.)

She went to "school at about six—was obliged to stay home after about a year on account of sore eyes (ophthalmia) and on account of her head, which would ache, and also on account of attacks of dizziness." (Q.)

"When M. was about ten years of age, she was found in the house of her parents, lying on the ground all bleeding in her face, with her mouth distorted, and in a state of unconsciousness; at this time she hurt or cut her forehead and the scar still remains; when she came to herself, she was asked how she had come to be upon the ground bleeding, but she did not recollect what had happened to her and said that she did not know; that prior to this seizure or attack, her head whirled around, just like a machine, and then she did not know any more; that when her head became thus, she saw something red, like a flash of light, and that the next thing that she remembers was when she found herself upon her bed and her mother

asked her how she fell on the floor; that after the flash of light appeared to her, she could see nothing and everything became black before her eyes. At this attack, as well as at the one at four, M.'s clothes were found wet with urine." (Q.)

When M. was about 15, one day a cat knocked down a cage with a bird in her presence, whereupon M. became frantic with fear, and ran to her mother crying that ghosts were after her. It took her a long time to recover from her emotion, and she would never walk in the dark after this incident, and was, and still is, afraid to sleep without a light.

Puberty at about fourteen; nothing special recollected.

No serious diseases, save small-pox at about fifteen; attack light, no consequences.

"Since her childhood M. had now and then attacks of anger, when she would beat her head on the wall, bite her hands and at times fall. Had some saliva at her mouth every time she had such an attack. The last similar well-remembered attack occurred about two years ago, and was due to a little scolding at home." (W.)

"Ever since her childhood M. has had frequent headaches and vertigos, and suffers with the same up to the present time. The headaches were and are mostly frontal (forehead). They come on once or twice a week, seldom less frequently, and are sometimes very severe." (Q.) Her eyes sometimes turn red during these spells and are always more feeble. Her face is sometimes pale, sometimes flushed during the seizures.

"With, but also without, these headaches, she suffers from vertigo. Her head seems to turn around or, when the dizziness is severe, everything will turn around with her; she is unable to work at such times." (Q.) There is no special time for these vertigos, no known cause, and no certain duration—they may be very transitory, lasting but a few seconds, or much longer. When they are severe, she stumbles and would fall, were she not to hold herself; "the floor seems higher to her and to be moving up and down.

She will be affected similarly at night even in sleep; feels sometimes as if the bed moved all around with her; when she wakes up afterwards, she finds her covers deranged and that she has a dull headache." (Q. and W.)

"At the age of about nineteen, M. came from Italy to America. When she arrived in New York she began to work at sewing, her employment being of the simplest sort. About four years ago, when M. was about twenty years of age, she was one day talking with some members of her family; some question was being discussed, when suddenly, without any apparent provocation, she uttered a scream, ran toward the window and was in the act of throwing herself therefrom, when she was prevented from so doing by one of the members of her family. She was then placed on a chair and while sitting on the chair, commenced to tremble and to shake all over, so much as to knock her head against the wall at which the chair stood; then all at once she relaxed and remained powerless; then she was placed upon a bed and remained there apparently in deep sleep for some hours, when she awoke; after awaking, on being asked why she had sought to throw herself from the window, she answered 'you are crazy, I don't remember, I never tried to throw myself from the window.' Prior to this suicidal impulse and convulsive seizure M. recollected she had felt her head going around and she saw something in her eyes, and then she did not remember anything until she was informed afterwards that she had attempted to throw herself from the window." (Q.)

"On another occasion, about three or four months after the foregoing attack, M. was discussing some question concerning work or the like with other members of the family, when she became somewhat excited, and all at once started to run up to the roof of the house. Her father ran after her and was just in time to catch hold of her by the hair and the back of the dress in order to prevent her from jumping from the roof; he then took her down from the roof and placed her upon a chair; she then began to

shake, her arms became stiff, and her head was thrown backward; then she seemed to pass into slumber and did not awake until after a couple of hours or so. When they asked what was the matter, she replied that she did not remember anything. Just previous to this suicidal impulse, M. said she saw some red and black lights, that then she felt something awful hot in her head, as if somebody had put hot water in it, and she did not know anything else of what she did until she was informed subsequently of her attempt to throw herself from the roof." (Q.)

"M.'s sleep has never been very good. She has very frequent dreams about cats, which seem to come and jump on and all over her, whereupon at times she wakes up feeling very tired, and for a couple of hours her head feels very uncomfortable and painful." (Q.) On these occasions when she wakes up she find her bed clothes deranged, or on the floor, and once about two weeks ago (in the Tombs Prison in New York city) she found herself on the floor after such an experience. Her sleep has always been troubled and while asleep she has often uttered sounds, whereupon she has awakened, and when asked, has said, that she did not remember anything at all. She has, frequently, motor dreams, particularly of the falling character, from which she wakes up with a start, in fright.

The subject has always been inclined to dejection, which came on in spells and at times without her really knowing why. Never has spells of hilarity. Always irritable, often forgetful. Never harmed anything or anyone.

Always very religious, especially after puberty; would go to communion every Sunday, and every day she could to church. Had often to be scolded for it. Would take rosary to bed with her every night.

Character always nice, honest. Was much liked by all she came in contact with; was never known to lie. Not sociable; very affectionate. Subjective feelings occasionally "as if not of this earth." Spells of unaccountable nervousness. Frequently numb in feet.

Has never had real *tædium vitæ*, nor any suicidal

thought. Tolerant to a certain degree of both alcohol and tobacco. No bolus, borborygmi, constrictions of throat nor any hemiæsthesias.

“ Since she has been in America, M. has always worked; she did a simple kind of sewing until on or about the first of April, 1895. While employed thus, she met, during the fall of 1893, or a little over three years ago, a man, who almost immediately became exceedingly persistent in his attentions to her and his pursuit of her. From the time that M. first became acquainted with this man, until on or about March 28th, 1895, she continued her work at sewing in various tailoring establishments; up to the time of her meeting this man, she had had no intercourse of even a social nature with men outside the members of her own immediate family.

On or about March 28th, 1895, after a pursuit of several months, after repeated endeavors on the part of M. to avoid him, this man allured her into a room in some hotel and dishonored her. Between the time of the aforesaid seduction and April 26th, 1895, with the exception of two or three days directly after the seduction, M. lived with this man in apartments provided for her by him, and during this time she seemed to be possessed of one paramount and all-absorbing idea and purpose, namely, to become the wife of her seducer in order to be able to return to the home of her parents.

During the time that M. lived with this man, who subsequently came to his death on the 26th of April, 1895, continual discussions occurred between the two, during which she implored and prayed him to marry her and save her honor. He struck and beat her at times, but she did not evince any anger or menace him in any way whatsoever; her demeanor and deportment were during this time tearful, despairing and beseeching; she took but little care of herself, her appearance or her environment; she also apparently lost flesh. She declared to an acquaintance an intention to make away with her life, unless by marriage to the man she could return to her parents' home.

She was at this period frequently seen sitting with arms and hands folded, with head down, unoccupied, except apparently with moody and melancholy thoughts, and then suddenly she would burst out into a fit of weeping." (Q.)

"During the time in which M. lived with her lover, in addition to her beseeching him to marry her and his refusals, there were interspersed not only blows and at times promises to marry that were always broken, but also, in the hearing of M. the deceased boasted of seductions that he had made in cases other than hers; he showed M. pictures of other women that he had ruined, and boasted of his acts in this direction, humiliating M. at the same time. About ten or twelve days before the 26th of April, the day on which her seducer was murdered, M. was heard weeping in the hall of the house where she lived; a neighbor, hearing her weep, called to her, and she approached still tearful; the person who had called to her asked her what was the matter, and whether or not she would step into his apartments and drink a cup of coffee with himself and wife, who were at breakfast.

She refused and turned to go away, when the attention of the man, who had called her and who had in the meantime turned around, as well as the attention of his wife and a friend, who were within the room, was attracted by hearing some kind of a sound, yell or scream coming from the direction of M.; the man who had first spoken to her turned immediately, saw M. falling, and was just in time with a jump to catch her in his arms. She then had some twitchings or contractions of the muscles, her limbs and body grew stiff, and she was carried to, and placed upon a bed in a seemingly unconscious condition; her body lay rigid on the bed like a corpse and her face was white and subsequently turned of a greenish cast; those who assisted her dashed water upon her face, but without effect; they noticed something about her mouth as if mucus or saliva had collected. She lay upon the bed in this condition for a period of eight or ten minutes, and then gave signs of recovery, long deep breathing preceded

ing her revival. When she came to, she appeared dazed and stupid and on being questioned, appeared not to know what was asked of her; she slowly arose from the bed and went to her own apartments without saying a word, seemingly very weak, scarcely able to walk and still remaining in the before-described dazed condition. Immediately preceding the attack just described, M. says she felt something coming to her head; that her head then grew hot inside and she could not see anything; that the next thing she remembered, and that but indistinctly, was that she found herself upon the bed where she had been placed by those who had carried her from the hall." (Q.)

"On the night of the 25th of April, 1895, the deceased took a photograph of himself and tore it into pieces, and M. secured another portrait of the deceased with the intention 'to look at his face, when she wanted, because she loved him;' there were some words, and M. did not sleep at all that night and ate no breakfast the following morning. On the morning of the 26th of April, M. and the deceased had their usual discussion and disagreement concerning marriage, wherein he reiterated his refusal to accede to her request. After this discussion, the deceased went to a saloon, two doors from the house in which he and M. lived. Within a few minutes of his arrival there M. entered the saloon. When she entered the place, she again talked with the deceased, asking him to marry her, and he refused. M. noticed then suddenly that her menstrual flow had begun, she left the saloon and went back to her apartments and put her hand in the trunk jointly used by the two, in order to get a cloth to fix herself with. She does not remember whether or not she did attend to herself; after she had gone up into the house where she lived to get the cloth, she says she was seized with an impulse to destroy herself and that when her hand accidentally came in contact with a razor, she took possession of it, not with any intent to use it upon the deceased, but in order if necessary to assist her in executing her desire to die; 'she would drown herself, or, if she could not do that, she would cut

herself here or there;' she claims she does not remember where she put the razor. She emerged from the house in which her apartments were situated and, with the suicidal thought in her mind, started to cross the street in the direction of the river near by—the saloon in which she had left the deceased being on the same side of the street as the house in which she lived. She halted and hesitated in the middle of the street and then returned in the direction of the saloon with the desire and intent, she says, to see her seducer once again before she died, because she still loved him.

When she reached the saloon, she found her mother there in tearful conversation with the deceased, beseeching him to marry her daughter M. M. then said 'Don't cry, mother, perhaps he will marry me.' M. was herself in tears at this time. The conversation or discussion as to marriage continued between M., her mother and the deceased. 'The demeanor of M. during this conversation was tearful, imploring and sorrowful; despair, not anger, was seemingly the emotion that animated her' (witness). The discussion was carried on very quickly and during the course of it the deceased asked the defendant's mother for money, as a price for which to purchase his consent to marry her daughter.

Finally the deceased was heard to refuse the request of mother and daughter, and say 'Only pigs may marry' or words of like import; almost instantaneously with the uttering of these words, M. approached the deceased and inflicted the wound which caused his death. Up to the time of the infliction of this wound M. had remained tearful and sorrowful in appearance, but at the moment these words were said 'her face was seen to change in color, turning pale, her eyes rolled and stared and her lips and the muscles of her face in general worked and became distorted.' She was heard to emit some sound or screech immediately before the fatal act. She was seen to fall almost immediately after the wound was inflicted on the deceased, and that apparently without being pushed or

slipping. After she had wounded the deceased, she moved away from him in the direction of the door of the saloon and it was there, several paces from where she had wounded him, that she fell.

The wound inflicted by her was made by a razor, and it began about two inches to the left of the median line of the neck, and passed across the neck backward up to the bony prominence behind the right ear; all the tissues in the neck were cut and the bony portion of the spinal column was considerably exposed." (Q.)

"After M. fell, directly subsequent to the infliction of the fatal wound, she in a few seconds or minutes, in some way not definitely known, arose, and was next seen on the sidewalk in front of the saloon, gesticulating; a witness thought he heard her utter some words of the following import: 'Die, you have taken my virginity.'

At this time, to wit, when she had emerged from the saloon after wounding the deceased, M. had froth or foam about her mouth, her face was white and her eyes like glass and staring; she was looking at her hands upon which there was blood and was rubbing them the one upon the other; she took up her skirt and removed the foam or froth from her mouth and then put her hands into a pail of water that was standing on the sidewalk in front of her.

M. herself declares that when she heard the words, 'pigs may marry,' she felt something exceedingly hot rising into her head, and saw some flashes of light, red, and then everything was black and she did not see any more; the next thing after feeling the above described sensations that she remembered was when she saw her hands covered with blood; at this time she was standing on the sidewalk near a bucket or pail of water; that she had no knowledge or remembrance of having in any way injured or wounded the deceased, and thought that she herself was wounded; that she felt something in her mouth just like soap and she wiped it off with her dress, and dipped her hands into the water in the pail which she saw near her; that then she became dazed and has but

an indistinct, dreamy recollection of anything that occurred for some time. When M. was on the sidewalk in front of the saloon gesticulating and acting in the way above described, her back was turned toward the direction in which the deceased had fallen after emerging from the saloon, when wounded by the razor." (Q.)

"After dipping her hands into water as above referred to, M. entered a grocery store, which was next to the saloon in which the deceased was wounded. There she was taken into custody by an officer. Before and after her arrest, she was passive, quiet and indifferent, and made no effort whatsoever to escape or in any way interfere with the officers of the law and is not known to have spoken anything coherent. After being arrested, she went with the policeman in whose custody she was to the apartments in which she had lived, that is, two doors from the saloon. On arriving there, she removed her waist and threw it out of the front window of the house in the presence of the officer and several others who were in the room.

While in this room, she was quiet and passive; she spoke little or not at all: her mother was in the room with her at the time, and at the suggestion of the policeman, who had charge of her, another waist and a hat were procured for her by her mother, with whose assistance they were put on; during the time she was in this apartment, a period of about twenty minutes or thereabouts, she stood quietly and did not seem to be in any way excited or concerned. On the way from her home to the station-house, she was quiet and passive, and although her mother accompanied her, there was scarcely any conversation or talk in which M. indulged on the way; when she arrived at the station-house, she still seemed cool, calm and unconcerned, as if nothing had happened. The fatal deed happened somewhere between nine and ten o'clock in the morning and it was about thirty minutes or so after its occurrence that M. was brought to the station-house as above described; from the station-house to which she was first brought, she was subsequently brought to another

station-house about three-quarters of a mile distant. She walked quietly and passively from the first station-house to the second; she did not speak at all on her way from station to station, but continued unconcerned and passive; when she arrived at the second station-house, she was still very quiet and in no way showed any emotion, effect, or concern; when she arrived at the second station-house, it was about noon." (Q.)

While at the second station-house, M. was asked about her deed. She was told by several persons before this time of what she had done. On being asked at the station-house by an officer and a reporter, what she had done, she made an attempt at describing her relations with the deceased, she essayed to explain several secondary particulars connected with the murder, but as to the act itself, she could give no explanation; nor any reliable information as to the mode in which it happened.

"While in the sergeant's room at a police-court on the day of the murder, she seemed dazed, bewildered and irrational; for fifteen minutes she sat in a chair almost motionless with her eyes half closed and fixed. She was addressed through an interpreter during this time, and it was only after repeated questions that an answer or an intelligent answer could be elicited from her; as soon as she would seem to recover from her condition of apparent lethargy and stupor and respond to a query, she would again relapse into the condition above described." (Q.)

"On the day of the homicide, or shortly thereafter, and for a period of about two and a half months, M. was confined in the Tombs Prison, New York city, awaiting trial; during this period her condition was almost uniformly that of one half dazed and stupefied, except that at infrequent intervals she would have fits of weeping; during this time she wept and brooded much, refused food to a marked degree and suffered to a great extent with insomnia." (Q.) On two occasions during this part of sojourn in prison, M. was witnessed to have an attack of some kind. One of these attacks occurred during a

the falls.

Unsound sleep always; bad dreams.	Sleep always light; bad dreams at times.	Much insomnia; bad dreams frequent.	Sleep not good; bad dreams often.	Sleep often unsound; bad dreams frequent.
Partial intolerance of drink, tobacco.	Intolerance of tobacco smoke.	Intolerance of drink and smoke.		
Various sensory and motor disturbances.	Various sensory and motor disturbances.	Various sensory and motor disturbances.	Sensory disturbances.	Sensory disturbances; some abnormal motor signs.
Sexual neurasthenia.		Sexual neurasthenia.		
Character melancholy; spells of uncontrollable anger.	Sad, fearful, very religious.	Character melancholy; egotism; spells of anger; thoughts of suicide; very self-restrained.	Much fear in dark, of cats.	Sedate. Spells of anger.

Unhealthy children, (husband all right).

MARIA (24 y.)

Began to speak later than the other children of the family, feet weak up to 5 years.
Headaches, frontal, frequent since childhood.
Vertigos, with or without headaches, since childhood.

religious service. Both these attacks were almost uniform when they came over M.; she grew pale, there were some twitchings of muscles or small distortions, and then M. would drop down to the floor unconscious. She knew nothing of these attacks on coming out of them.

“M. was tried for the murder of her seducer on July 8th, 1895, and the days following. During the progress of this trial, she was nervous and otherwise perturbed to such a degree that the trial had to be stopped in at least three instances before she recovered sufficiently to have the trial proceeded with. She was immediately, after the conclusion of this trial, taken to Sing Sing Prison, there to await the result of an appeal, which had been taken from the judgment of conviction. During M.'s stay at Sing Sing, from about the middle of July, 1895, until about the 1st of May, 1896, her life was marked by symptoms of confusion and dulness at first, accompanied by frequent spells of weeping, and later, though she became brighter and generally more cheerful, by a more conscious and continuous sorrow. At first, during her stay at Sing Sing, she ate and slept but little, was dazed and wept, but later on, owing to the influence of the treatment she was given, began to brood and despair less; here, in Sing Sing, she learned to read and write the English language a little. In April of 1896, tidings that the Court of Appeals had given her a new trial reached M., but she seemed totally uninterested and indifferent at the news. From the time of her return to the Tombs on or about May 1st, 1896, she had been exceedingly nervous and frightened, much inclined to spells of dejection, and subject to fits of violent weeping. She claims she has now absolutely no recollection of killing her seducer, and knows that he was wounded and died only through information received by her from others.” (Q.)

PART II.

ANTHROPOLOGICAL EXAMINATIONS OF THE BARBELLA FAMILY.

B.—EXAMINATIONS.

The majority of the more objective examinations which are to follow were made at the Institute, during the months of October and November. I shall present these data in the same order as I have given those obtained by information. The methods followed in these examinations were as follows: In obtaining the more medical data, I have followed the best general clinical methods; the anthropological examinations were carried on on the basis of the French School or Broca's procedure, and with the most approved instruments of the French anthropologists; and the more purely psychological statements were obtained in each case from a careful observation of the subject during his examination, and by especially directed questions.

A number of the individual examinations is supplemented by photographs of the subjects. These photographs were secured three months after the trial ended, and consequently they may be expected to show each subject in his natural condition. The heads were brought, as far as possible, to the anthropological plane, that is a position in which a plane stretching from the subnasal point to the external auditory meati is about horizontal.

In order to make the anthropological examinations of M. more valuable, I examined in the same way twenty adult women from the same town that M. comes from. The data obtained on from fifteen to twenty persons from the same locality and from the same social class, can be considered as an anthropological standard (Broca), to which then any individual from the same locality and same social class may be safely compared. I append these examinations to the others:

M.'S FATHER.

STATUS PRAESENS:

Height 1.62 metres; weight 135 lbs.

State of nutrition and blood supply—somewhat reduced.

Measurements of the Head:

Circumference max.....	55.5 cm.
Nasion—point max.....	33.3 "
Nasion—ophryon.....	1.8 "
Supraauric. points—forehead.....	28.2 "
" " insertion of hair.....	30.7 "
" " bregma.....	32.5 "
" " max.....	34.7 "
" " inion.....	28.6 "
Diam. antero-poster. max.....	18.25 "
" breadth " 	15.12 "
Form of head—subbrachycephalic (Broca), index....	82.8 "
Diam. frontal minimum.....	10.3 "
" biauricular.....	13.0 "
" bimalar.....	12.1 "
" bigonial.....	9.2 "
Face (chin—nasion).....	11.6 "
Forehead—hair-line advanced by calvitia,	
Length of nose.....	5.1 "
Breadth of nose.....	3.45 "
Index of nose, 67.6—leptorrhynian.	
Length of left ear.....	6.0 "
Breadth of left ear.....	3.4 "
Length of right ear.....	5.85 "
Breadth of right ear.....	3.4 "
Eyes—separation of ext. borders of orbits.....	9 6 "
" " inner canthi.....	3.75 "
Expanse of lips.....	0.9 "
Expansion of arms.....	1.62 metres.

Special Anthropological Signs.—Chest protruding.

Breadth at nipples..... 25.3 cm.

Depth at nipples..... 23.9 "

Ears somewhat irregular, particularly the right; helix plied on itself.

Teeth very much used up; flattened from top.

Unusual hairiness on arms and chest; tufts of hair on the shoulders.

Color of eyes—brown.

Color of hair—gray, black originally; baldness advancing from front.

Temperature 98; pulse 68, normal; respiration 19, normal.

Tongue—no deviation or tremor, lightly covered.

Special senses—normal, as far as can be determined.

Reflexes—patellar much diminished, especially on right side; light reflex about normal, accommodation diminished.

Motor functions—about normal, no ataxia.

Secretory functions—often sweats considerably.

Bowels costive; must smoke in the morning to have a movement.
Hæmorrhoids.

Urine—nothing special.

Internal organs healthy.

Expression and looks—the subject looks neuropathic, has sunken eyes; many wrinkles.

Sleep—not sound, cries during it sometimes.

Psychical Examination:

Disposition mild, morose at times.

Ideation slow, intellectual qualities in general of low average.

Psychical sensibility—low but present.

Comprehension—tardy.

Memory—weak at times.

Is religious; no excess.

Not indolent.

Moral sentiments present; very ordinary.

No fixed ideas, illusions, hallucinations or perversions.

(Photographs. See Figs. 1 and 2.)

M.'S MOTHER.

STATUS PRAESENS:

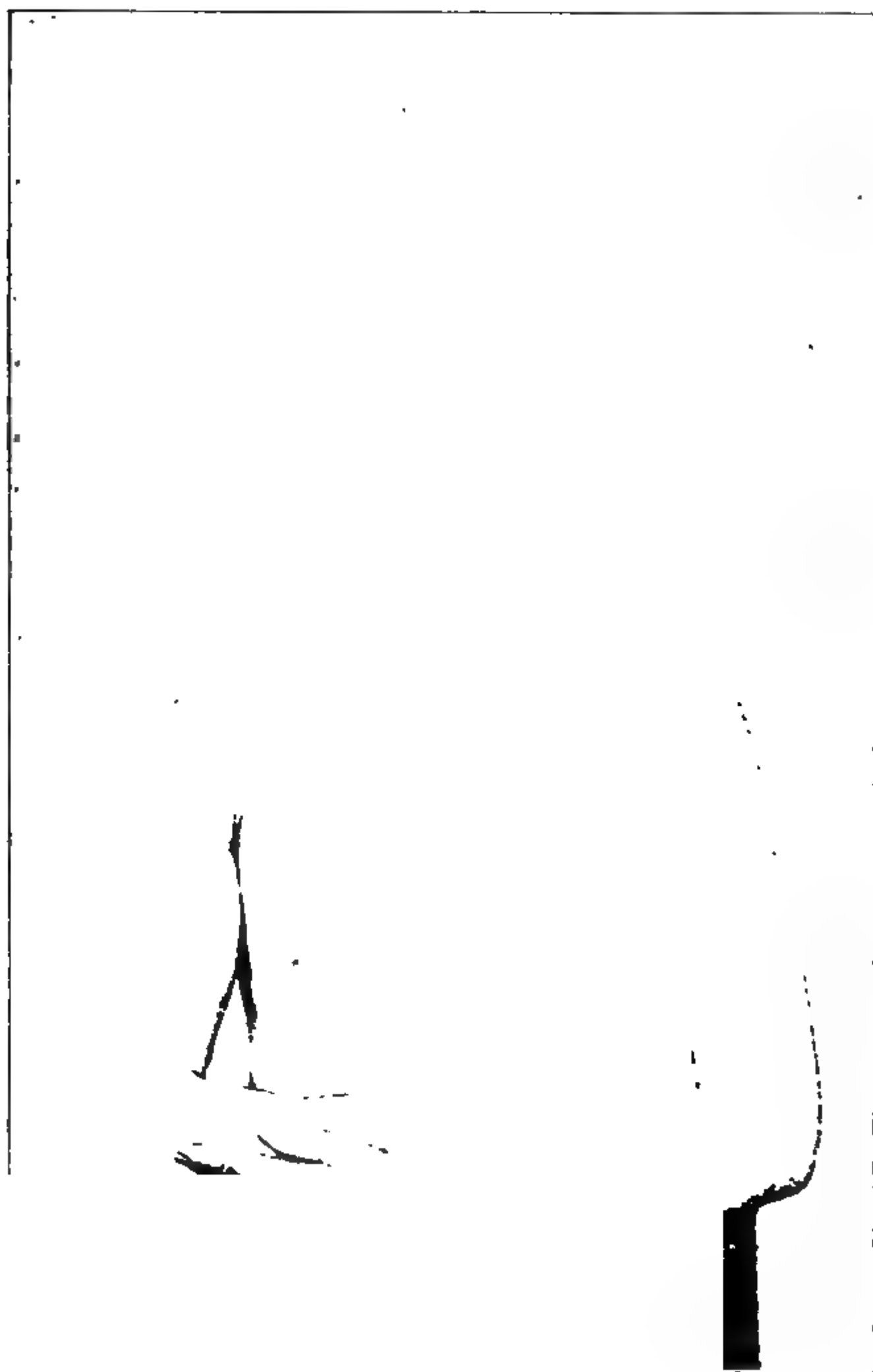
Height 149 metres; expansion of arms 1.49 metres; weight 95 lbs.

State of nutrition and blood supply—somewhat subnormal.

Skin dry, hands cold.

Measurements of Head:

Form of head—subbrachycephalic, index.....	81.0 cm.
Circumference max.....	50.6 “
Nasion-inion.....	30.4 “
Ophryon-inion.....	29.1 “
Supraauric. points, forehead (s. a. p. Broca).....	26.0 “
“ “ bregma.....	31.4 “
“ “ hair insertion.....	27.0 “
“ “ occip. max.....	33.1 “
“ “ inion.....	26.4 “



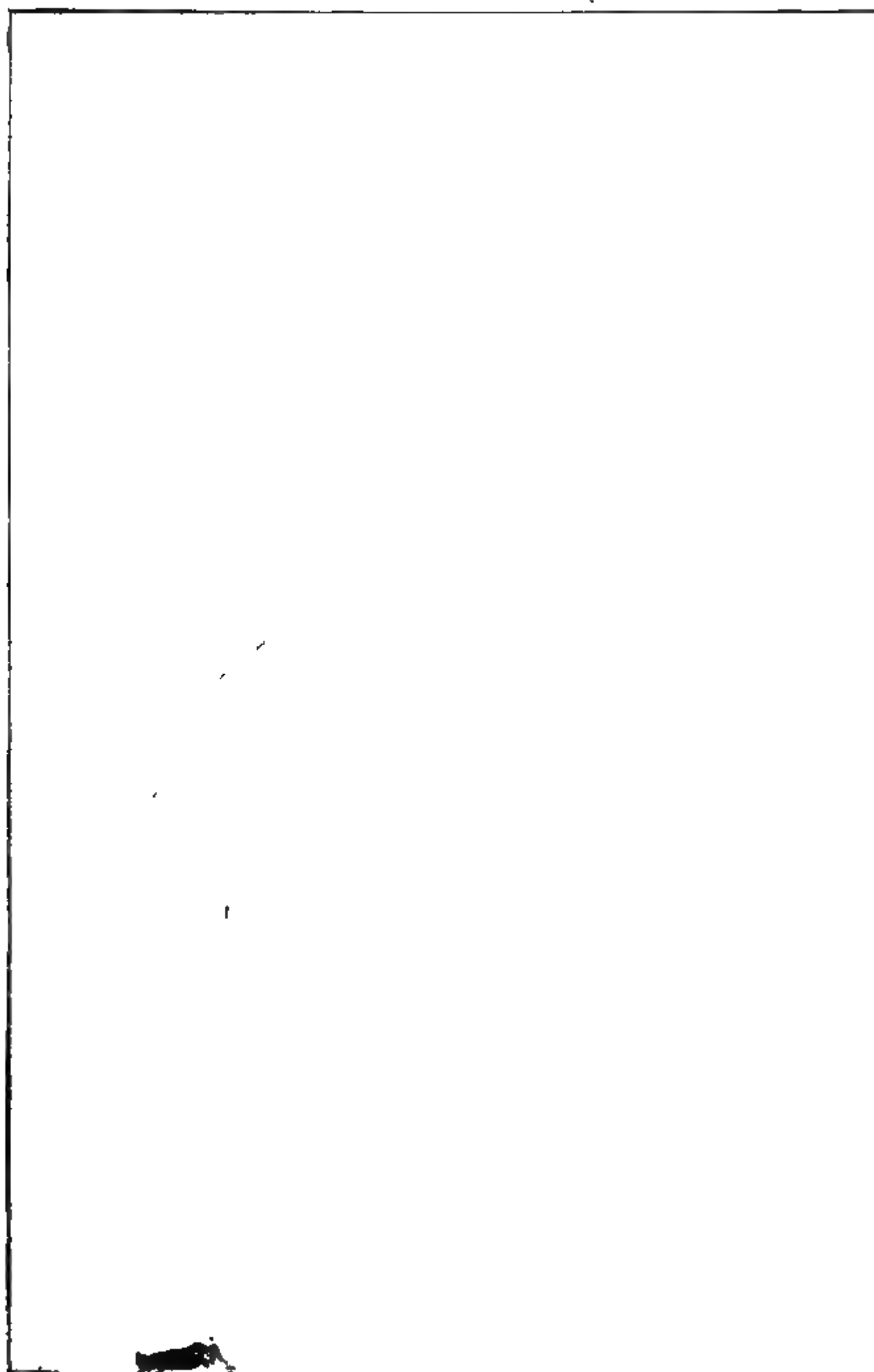
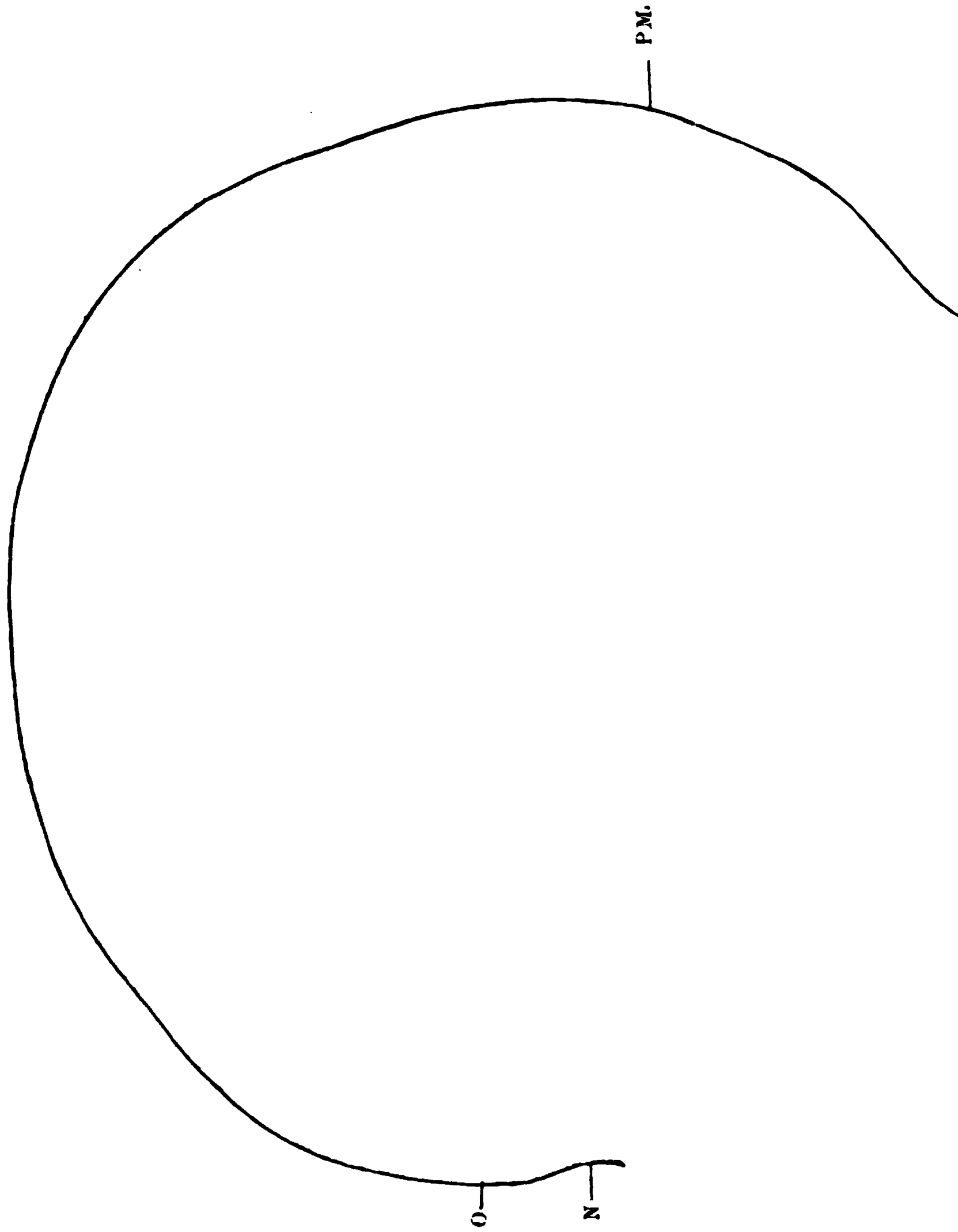


FIG. 111.



Mr. BARBELLA.

N.—nasion.
O.—ophryon.
P. M.—point maximum
(Antero post Arc, obtained by the means of an alloy tape and measure.)

Maximum length.....	16.8 cm.
" breadth.....	13.6 "
Diam. biauricular.....	12.0 "
" frontal minimum.....	9.7 "
" bizygomatic.....	10.5 "
" bigonial.....	8.35 "
Height of forehead.....	4.0 "
Height of face.....	12.0 "
Length of nose.....	5.25 "
Breadth of nose.....	3.15 "
Nasal index—60—leptorrhynian.	
Length of left ear.....	5.65 "
Breadth of left ear.....	2.95 "
Length of right ear.....	5.60 "
Breadth of right ear.....	2.90 "
Expansion of lips.....	1.55 "

Special Anthropological Signs.—Very high roof of the hard palate.

Color of eyes—brown.

Color of hair—black (few white).

Temperature 97.5; pulse 78, normal; respiration 23, normal.

Tongue—clean, no deviation, no tremor.

Teeth—medium condition, neglected.

Sight—somewhat feeble.

Hearing—right ear found duller.

Taste and smell present, degree undeterminable.

Sensibility—very difficult of testing on account of the insufficient intelligence of the subject, but appears about usual regarding the tactile sense, two points of the æsthesiometer being recognized on the upper surface of the forearm after a separation of 40 mm.; and lessened, regarding the sense of pain.

Reflexes present, about normal.

Secretory and excretory functions—the subject knows of nothing abnormal.

Motor functions—nothing special.

Body somewhat under-nourished.

Chronic blepharitis, external tear-flow.

On left breast, above the nipple, a long scar (due to operative interference during the first lactation), nipple effaced.

Thoracic and abdominal organs found healthy.

The behavior and look of the subject—shows no sentimentality whatever, but a general, moderate, intellectual restriction. Is not nervous, but gets weary and duller. The examination was a strain to her and was followed by much headache.

Sleep and dreams—the subject sleeps but little, and never until after she has laid in bed for two or three hours; her sleep is never

sound; there are dreams almost always, though not of any special character; and on awakening the head usually feels bad, or there is a headache.

Psychical Examination:

Disposition irritable (attested by other members of the family) and at times morose or gloomy, worse when she suffers physically. Impulsive. Psychical abilities and endurance small.

Memory good at times, not at others.

Moral sentiments—good; æsthetic—those of low average.

There could be determined no fixed ideas, morbid fears, illusions, hallucinations or perversions. (See Figs. 4 and 5).

M.'S OLDEST BROTHER.

Height 1.673 m.; weight 145 lbs.

Arm expansion 1.633 m.

State of nutrition—fair.

State of blood supply—somewhat subnormal.

Skin—healthy.

Measurements of Head:

Circumference max.....	56.6 cm.
Nasion-inion.....	32.4 "
" ophryon.....	30.3 "
" bregma.....	13.7 "
Supraauricular points—forehead.....	29.2 "
" " insertion of hair.....	31.0 "
" " bregma.....	33.3 "
" " max.....	35.4 "
" " inion.....	28.2 "
Diam. antero-poster. max.....	19.2 "
Breadth max.....	15.38 "
Form of head—subbrachycephalic (Broca); index....	80.1
Diam. biauricular.....	13.58 "
" frontal minim.....	10.7 "
" bimalar.....	11.1 "
Diam. bigonial.....	10.0 "
Height of face.....	12.2 "
" forehead.....	5.8 "
Length of nose.....	5.75 "
Breath " 	3.15 "
Index, 54.7—leptorrhynian.	
Eyes—separation of ext. canthi.....	10.2 "
" " int. " 	3.45 "

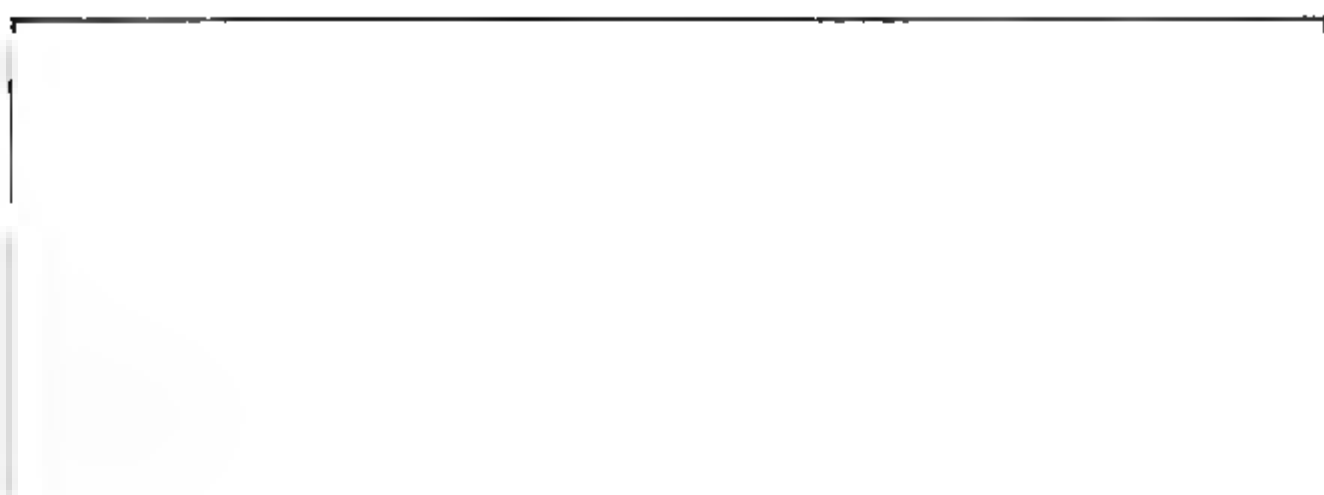
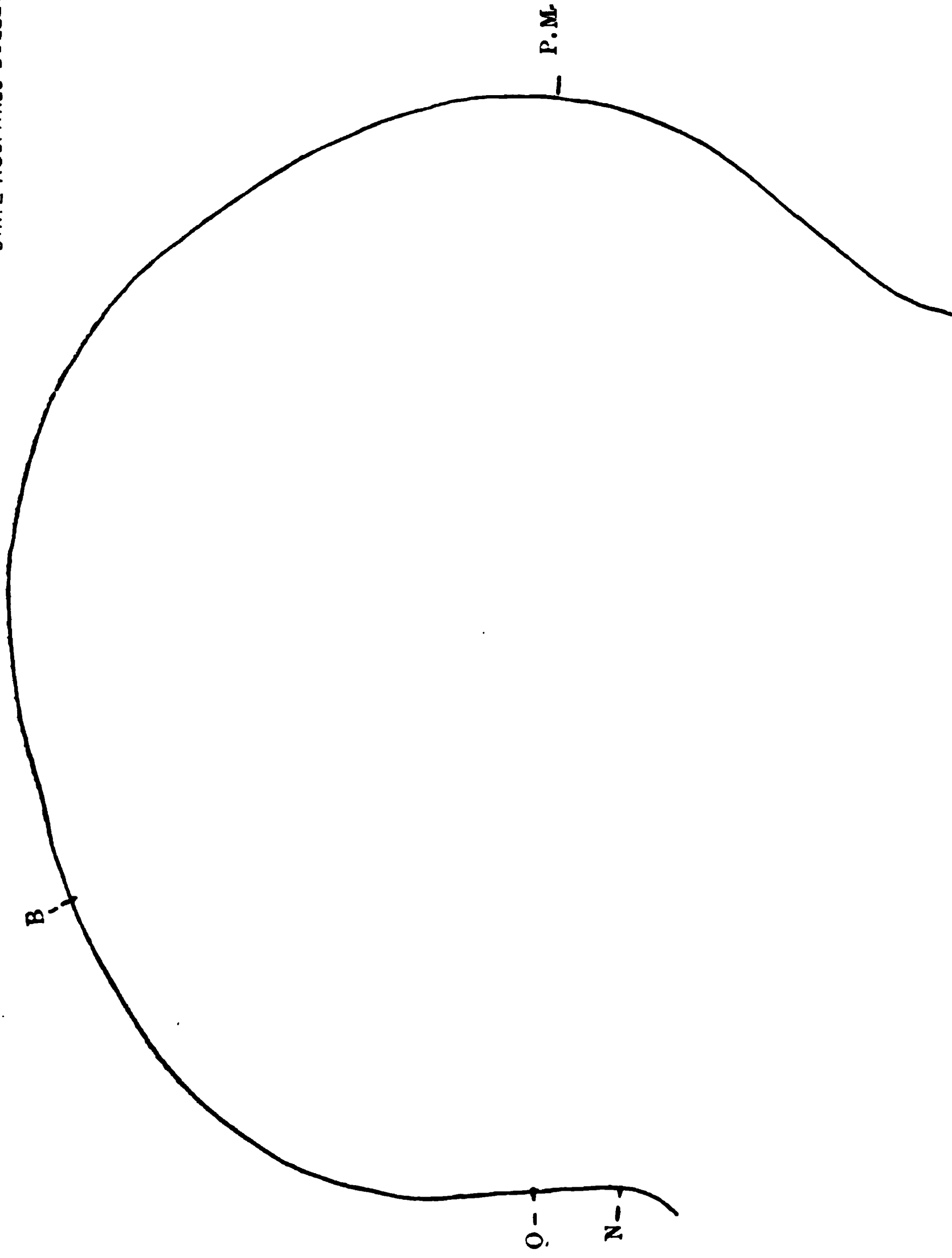


FIG. VI.

STATE HOSPITALS BULLETIN.



PHILOM. BARBELLA.

N.—nasion. O —ophryon. B.—bregma. P. M.—point maximum.

Ears—left, length.....	5.60 cm.
“ breadth.....	3.42 “
Ears—right, length.....	5.68 “
“ breadth.....	3.00 “

Color of eyes—grayish blue.

Color of hair—black.

Temperature 99 (under the tongue); pulse 68, full, regular; respiration 22, normal.

Tongue—lightly coated at root, no tremor.

Denture—complete, good.

Marks or scars—scrofulous scars on the right side of his neck; scars on his back after scarification, and here and there those of small-pox.

Special Anthropological Signs.—Masses of hair on chest, median line of abdomen; limbs very hairy; tufts of long hair on the shoulders, and lesser over the supraspinal scapular region. Ears irregular—helix and antehelix somewhat deficient. High roof of hard palate.

Special senses—nothing abnormal determinable; sight somewhat weak (statement).

Reflexes—Patellar slowed. Irideal about normal. Skin and subcutaneous reflexes deficient—ticklish only on the soles of the feet.

Motor functions—about normal, no ataxia.

Secretory and excretory functions—nothing strictly pathological. Digestion fair, but very little appetite, always. Bowels costive at times. Some disturbance of sweating—augmented occasionally.

Internal organs—healthy.

Expression and look—obscure and painful to a degree; eyes look strange sometimes. Countenance pale, forehead wrinkled in median line. Is sombre, and rarely smiles.

Behavior—mild, kind.

Psychically:

Disposition—cheerful when fully well, otherwise gloomy, melancholy; at times attacks of uncontrollable anger, but no bad impulses—never harmed others, nor tried self-destruction.

Intellectual processes ordinary, when unwell difficult. Psychological sensibility heightened in some directions, self-control weakened. Not suspicious.

Comprehension—good.

Memory somewhat weak; lapses of memory (for whiles during his headaches; “could not remember even what he said or done just previous.”)

Affectionate; religious—no excess.

Moral sentiments—somewhat weakened, æsthetic of low average. No morbid fears, illusions, hallucinations, fixed ideas or perversions. (Photographs could not be obtained.)

M.'S SECOND BROTHER.

Height 1.63 m.; weight 130 lbs.; expansion of arms 1.58 m.; state of nutrition fair; blood supply not very stable, subject is often pale; skin healthy.

Measurements of Head:

Circumference max.....	56.7 cm.
Nasion—inion.....	35.4 "
" bregma.....	14.0 "
Supraauricular points—forehead.....	28.7 "
" " insertion of hair.....	30.7 "
Supraauricular points—bregma	34.0 "
" " max.....	36.2 "
" " inion.....	28.4 "
" " chin	30.3 "
Diam. antero-post. max.....	18.8 "
Lateral max.....	15.5 "
Form of head—subbrachycephalic (Broca), index.....	82.4 "
" " biauricular	12.7 "
" " frontal min.....	9.6 "
" " bimalar.....	11.1 "
" " bigonial.....	9.3 "
Nose—length.....	5.3 "
" Breadth.....	3.5 "
Index—66; leptorrhynian.	
Eyes—separation of ext. canthi.....	9.7 "
" " of int. " 	3.35 "
Ears—left, length.....	5.50 "
" " breadth.....	3.35 "
Ears—right, length.....	5.52 "
" " breadth	3.30 "
Lips—expansion.....	1.65 "
Face—height, (chin-nasion).....	11.7 "
" forehead.....	5.5 "

Color of eyes—brown.

Color of hair—black.

Temperature 99.5 (underneath tongue); pulse 78; respiration 22.

Tongue—slightly covered; no tremor, no deviation.

Denture—fair; no wisdom teeth out.

Marks and scars—scars on the right occipital region, one and a half cm. long, non-adherent; over the left eye, with depression in the bone, sensitive on touch, non-adherent; and on the tongue about one cm. from the tip and to the right of median line.

Special Anthropological Signs.—Roof of the hard palate much higher than average. Limbs and chest very hairy; much hair over

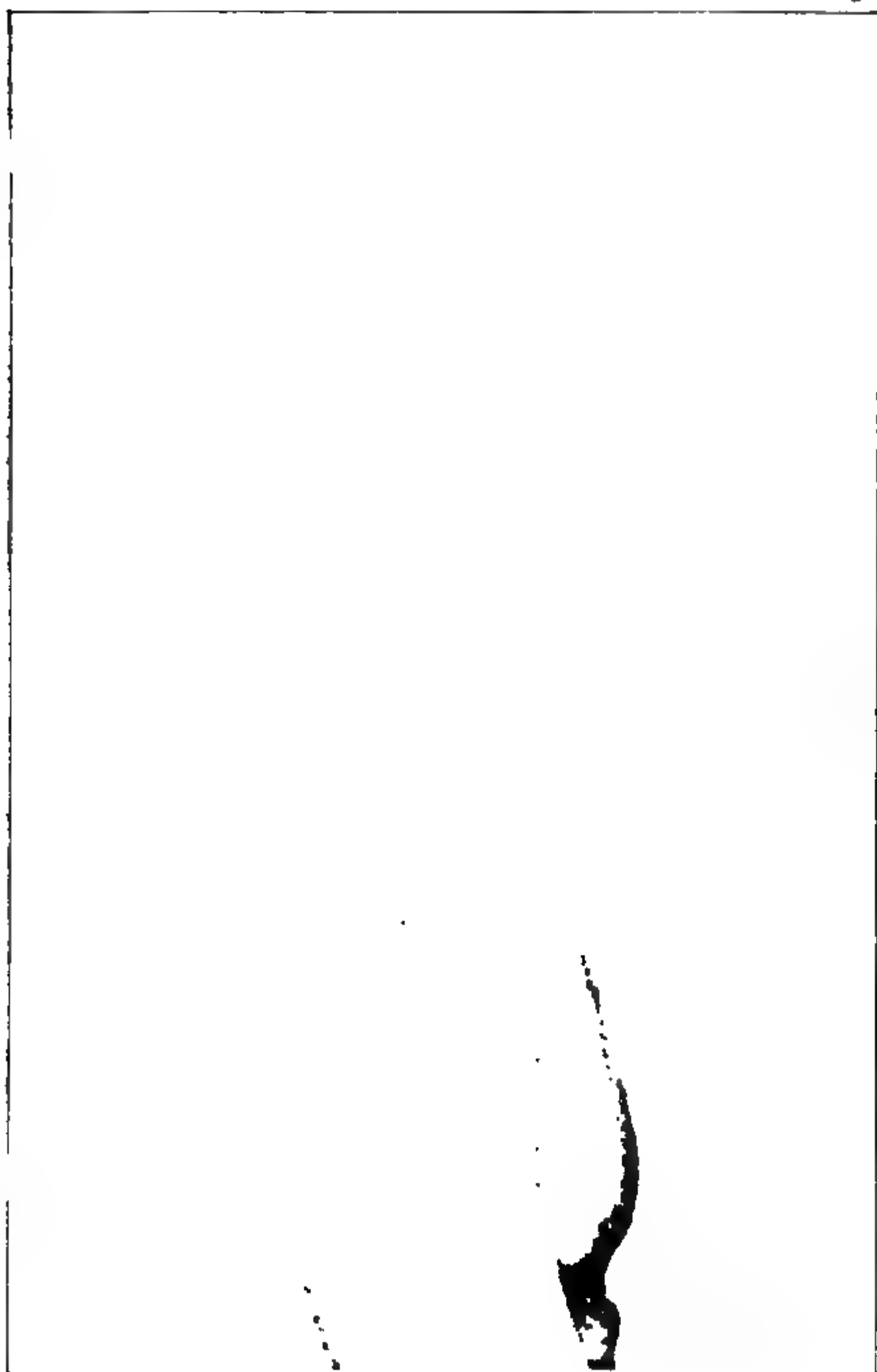


FIG. VI.

STATE HOSPITALS BULLETIN.

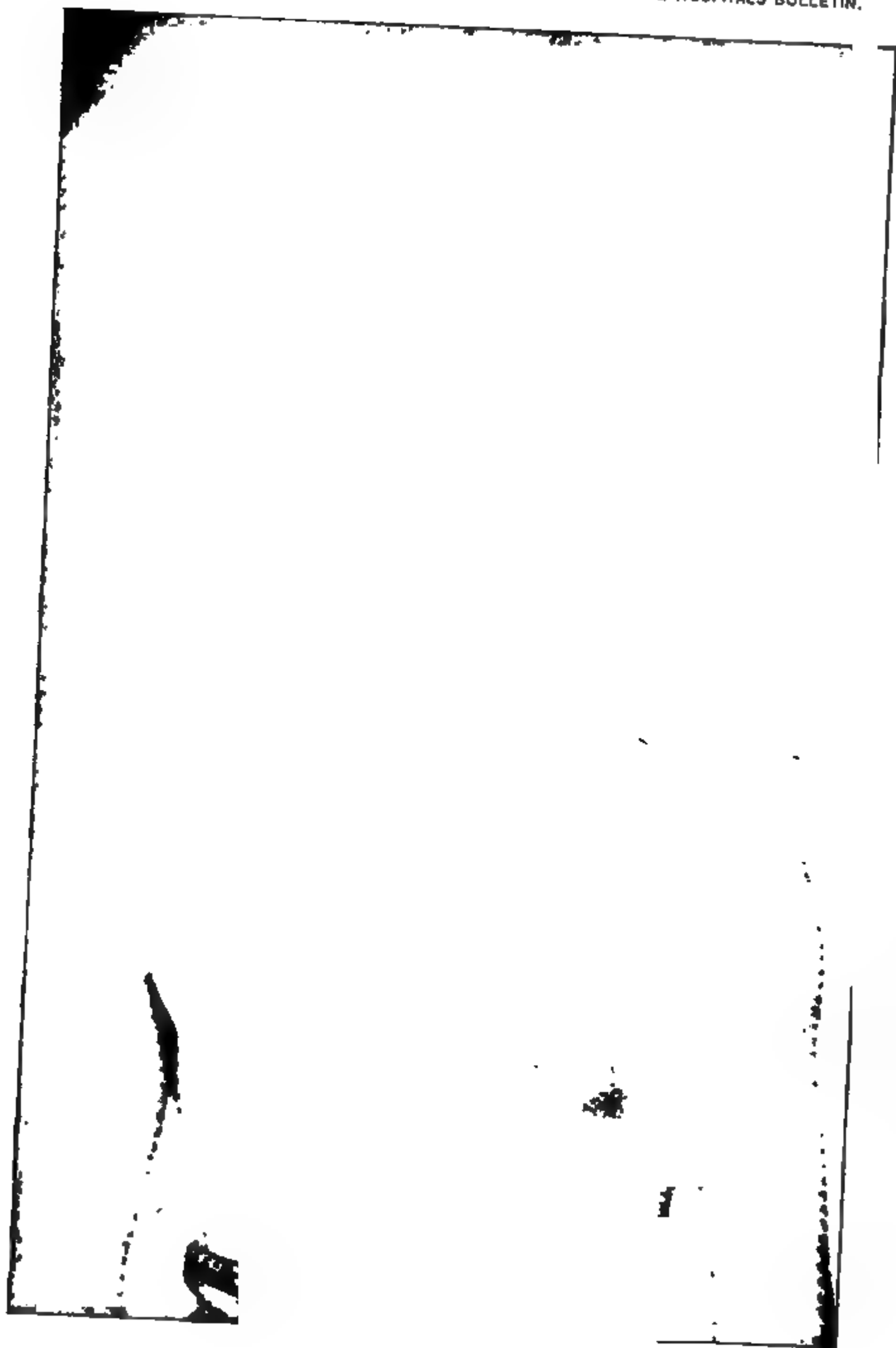


FIG. IX,

STATE HOSPITALS BULLETIN.

7

the shoulders and some long hair over the back, here and there, and over the spine.

Special senses—about normal.

Reflexes—patellar slightly slowed—irideal normal

Motor functions—normal.

Digestion—fair; appetite very poor.

Bowels—habitually costive.

Internal organs—healthy.

Expression and looks—gloomy, morose, skin on forehead contracted most of the time, smiles only with special effort.

Psychically:

Disposition—is very self-restrained, loath to speak or be bothered, easily angered, otherwise peaceful. Is religious, especially when feeling bad, but not bigoted.

Intellectual qualities—irregular, at times much better than at others; it is often difficult for him to think.

Memory—often weakened.

Considerable egotism.

Moral and æsthetic sentiments of low average.

Comprehension—limited.

Psychical endurance lessened.

No fixed ideas or perversions determinable.

(See Figures 7, 8 and 9.)

M.'S YOUNGEST BROTHER.

Height 1.34 m.; weight 74 lbs.

State of nutrition—good.

State of blood supply—fair.

Skin—healthy.

Spread of arms, 1.35 m.

Measurements of Head:

Circumference max.....	54.2 cm.
Nasion—inion.....	33.2 "
Nasion—ophryon.....	1.4 "
Supraauricular points—forehead.....	25.8 "
" " insert of hair.....	28.3 "
" " bregma... ..	31.1 "
" " max.....	34.4 "
" " inion.....	27.3 "
Diam. antero-post. max.....	1.80 "
" lateral.....	14.6 "

Form of head—subbrachycephalic (Broca), index.....	81.1 cm.
“ “ biauricular.....	11.8 “
“ “ frontal, min.....	9.6 “
“ “ bimalar.....	9.6 “
“ “ bigonial.....	8.6 “
Face—height.....	10.75 “
“ forehead, height.....	4.30 “
Nose, length.....	4.6 “
“ breadth.....	2.9 “
Index—63; leptorrhynian.	
Eyes—separation of ext. canthi.....	9.3 “
“ “ int. “.....	3.3 “
“ height of orbit.....	2.8 “
Ears—left, length.....	5.95 “
“ “ breadth.....	3.15 “
Ears—right, length.....	6.90 “
“ “ breadth.....	2.95 “
Lips—expanse.....	1.65 “

Color of eyes—brown.

Color of hair—black.

Temperature 99 (underneath tongue); pulse, 90, normal; respiration, 26, normal.

Tongue—clean, no tremor or deviation.

Teeth—in good condition.

Marks—scars; an elevated scar-spot on the inside and in middle of lower lip. A small, old scar horizontally over the glabella. Several small, irregular scars over the right front, above the insertion of hair.

Special Anthropological Signs.—Right ear markedly longer. Plagiocephaly—right side smaller in front and larger behind. High roof of the hard palate. Forehead hairy below the reg. line.

Organs of special sense—all right.

Reflexes—patellar on both sides much diminished; irideal and cutaneous about normal.

Motor functions—normal.

Digestion—fair; bowels regular.

Internal organs—healthy.

Look—more bright than other members of the family; at times somewhat peevish.

Behavior—nice, boyish.

Psychically:

Disposition mild, nice when well; depressed, irritable when suffering from headache.

Intellectual functions—those of common average, become restricted when unwell.



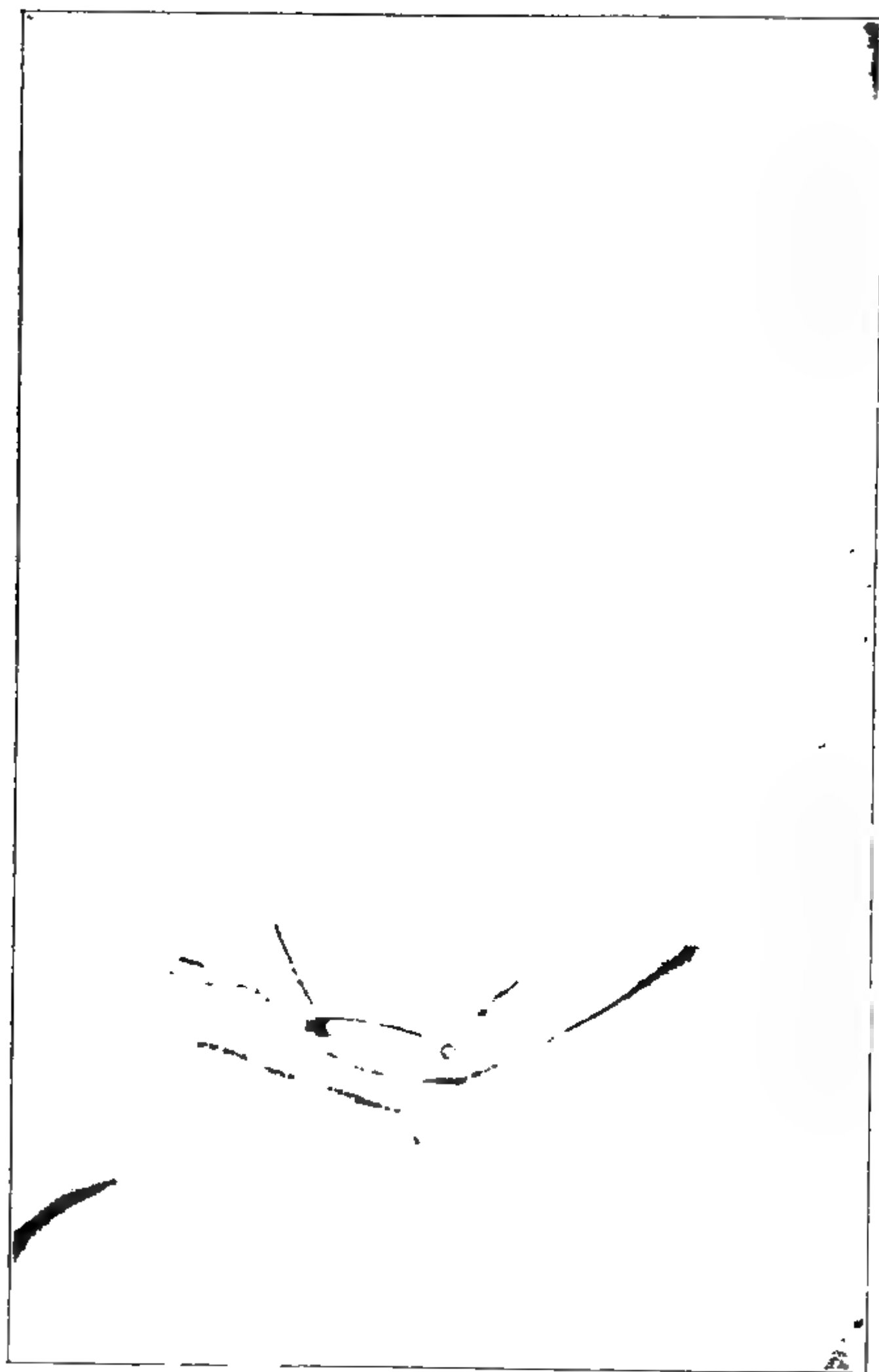
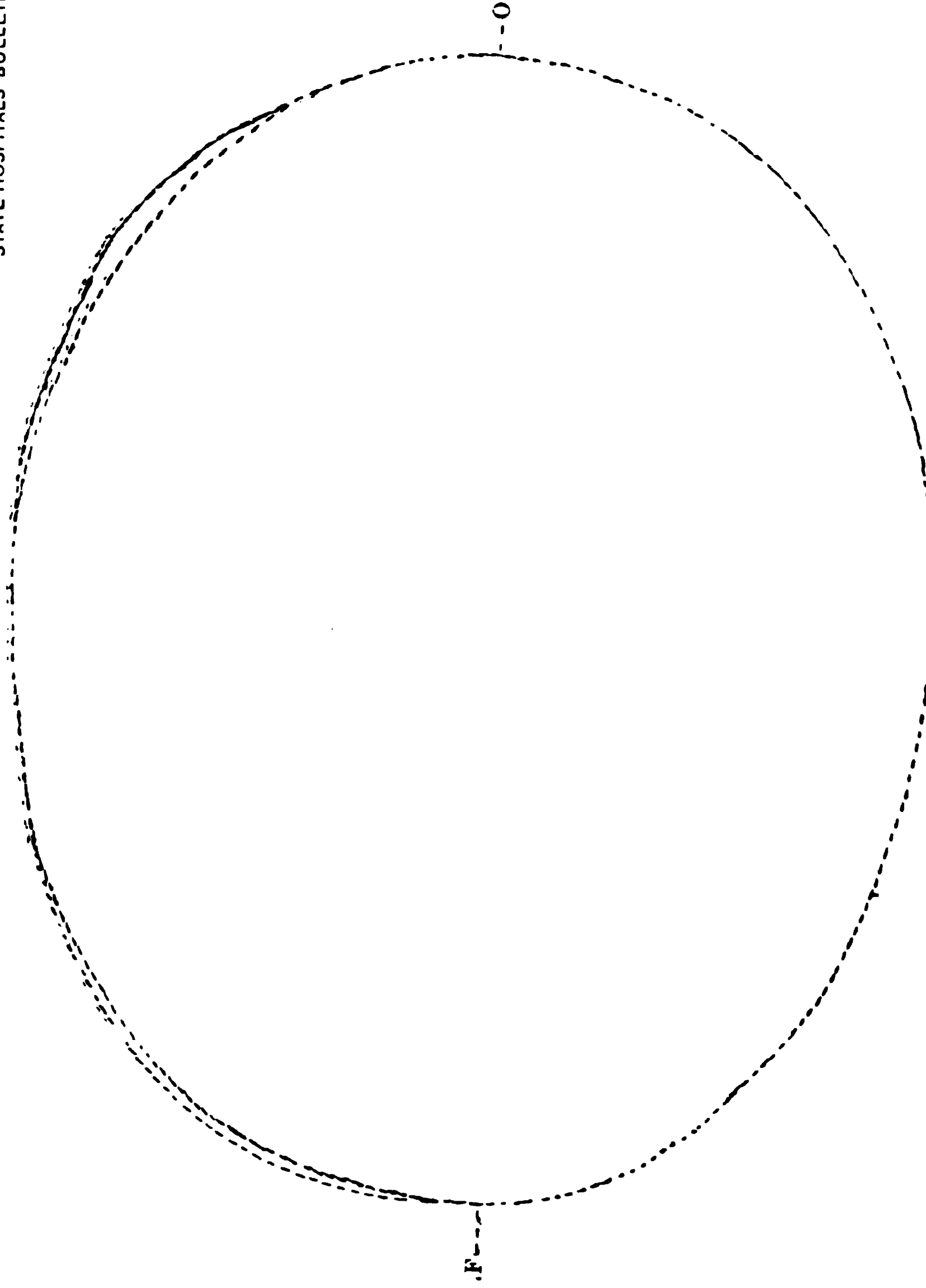


FIG. XIII.



Contour circumf. max. of John Barbella. (M's youngest brother.)

(Secured by means of an alloy tape and measurements.)

F. — front.

O — occiput.

Continuous line. — present state of head.

Dotted line — as the head should be, if it were symmetrical.

Memory—faulty at times, at others fair.
Moral sentiments present: æsthetic well developed.
No fixed ideas or perversions.
(Drawings and pictures. Figs. 10—13.)

M.'S OLDER SISTER.

Height 1.48 m.; weight 110 lbs.; arm expansion 1.49 m.
State of nutrition—good.
State of blood supply—somewhat unstable.
Skin—healthy.

Measurements of Head:

Circumference—max.....	54.0 cm.
Nasion—inion.....	32.8 "
" ophryon.....	1.3 "
" bregma.....	13.3 "
Supraaur. points—forehead.....	26.0 "
" " insertion of hair.....	28.7 "
" " bregma.....	31.7 "
" " maximum.....	34.0 "
" " inion.....	26.4 "
" " chin.....	29.4 "
Diam. antero-post.—max.....	17.3 "
" lateral.....	14.7 "
Form of skull—brachycephalic (Broca), index.....	84.9 "
" " biauricular.....	12.5 "
" " bimalar.....	9.8 "
" " bigonial.....	9.0 "
Face—length.....	17.9 "
" forehead.....	5.9 "
Nose—length.....	4.85 "
" breadth.....	3.13 "
Nasal index—64.5; leptorrhynian.	
Ears—left, length.....	5.53 "
" " breadth.....	2.78 "
Ears—right, length.....	5.40 "
" " breadth.....	2.58 "
Eyes—separ. of ext. canthi.....	9.55 "
" " " int. " 	3.45 "

Color of eyes—grayish blue.
Color of hair—black, hair profuse.
Temperature, 98.5 (underneath tongue); pulse, 86, normal; res-
piration, 22, normal.
Tongue—clean, no tremor or deviation.

Denture—good, complete.

Marks—scars; a longitudinal, old scar over the right frontal protuberance (length 1.25 cm.) Body could not be examined.

Special Anthropological Signs.—Very high roof of the hard palate.

Special senses—about normal.

Reflexes—normal.

Motor functions—normal.

Digestion and appetite—good.

Bowels—costive.

Often dry mouth.

Sweats easily.

Internal organs—healthy.

No gynecological disorder.

Physically resembles very much Maria.

Look—mild, somewhat unsettled. Behavior gentle.

Psychically:

All the psychical functions of average quality, but not stable enough; irregular; affected much by her physical disposition.

Is not impulsive and has no bad tendencies.

Moral sentiments—normal.

No fixed idea or perversion.

(Photographs not obtainable.)

M.'S YOUNGER SISTER.

State of nutrition fair; weight 74 lbs.

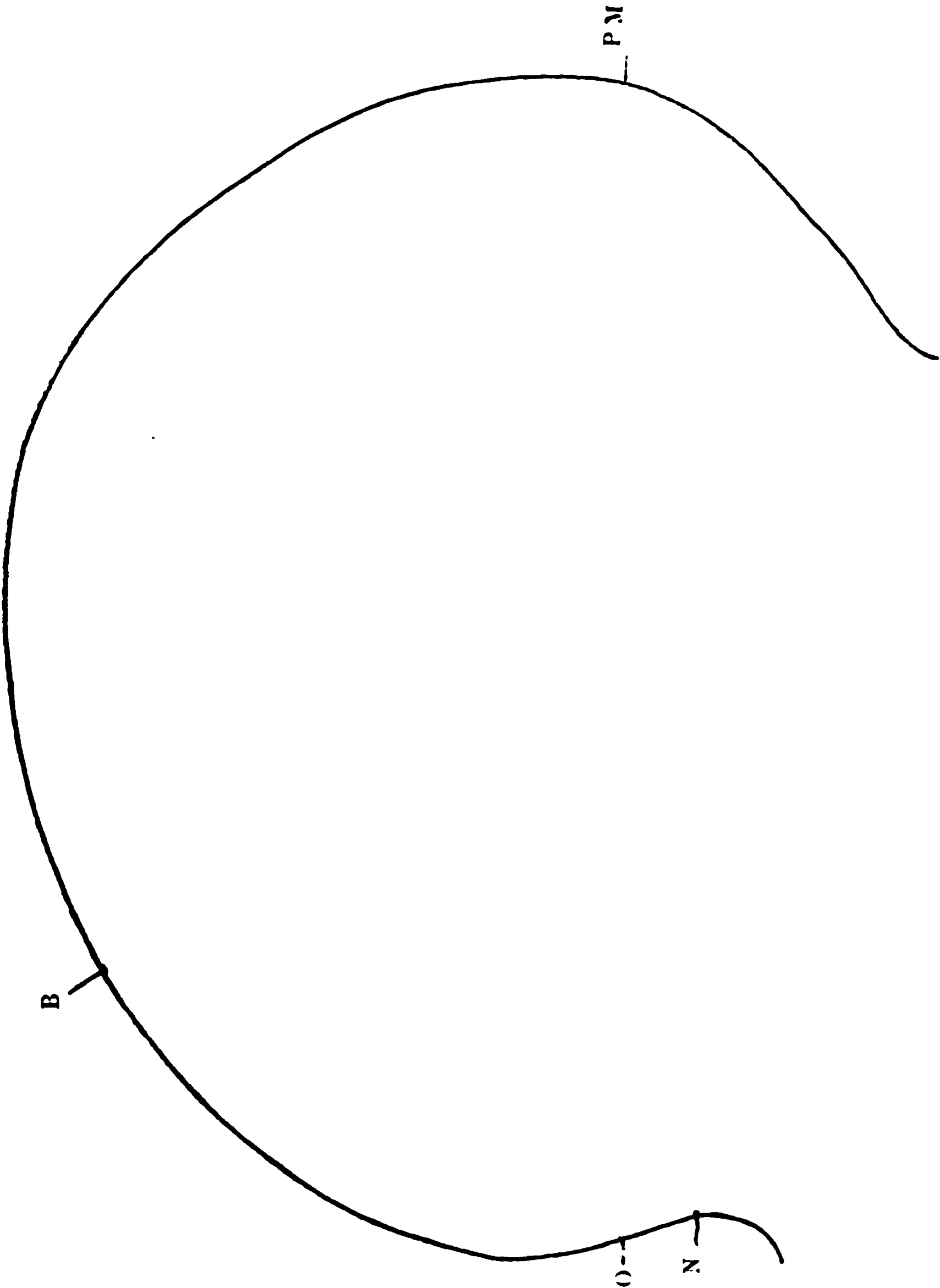
State of blood supply—not very stable; gets easily pale.

Skin—healthy.

Measurements of Head:

Circumference max.....	51.8 cm.
Nasion—inion.....	30.0 "
" ophryon.....	1.5 "
" bregma.....	12.8 "
Supraauric. points—forehead.....	24.5 "
" " bregma.....	31.8 "
" " max.....	35.5 "
" " inion.....	28.9 "
" " chin.....	25.63 "
Diam. antero-post. max.....	16.8 "
" lateral max.....	14.4 "

FIG. XIV.



JOAN BARBELLA.

N.—nasion.

O.—ophryon.

B.—bregma.

P. M.—pt max.

Form of head—brachycephalic (Broca), index.....	85.7 cm.
“ “ biauricular.....	11.0 “
“ “ frontal min.....	9.5 “
“ “ bimalar.....	9.4 “
“ “ bigonial.....	7.25 “
Face—height....	11.1 “
“ forehead—height.....	4.5 “
Nose—length.....	4.95 “
“ breadth.....	3.00 “
Nasal index—60.6; leptorrhynian.	
Eyes—separ. of ext. canthi.....	9.0 cm.
“ “ of int. “	3.15 “
Ears—left, length.....	5.40 “
“ “ breadth.....	2.95 “
Ears—right, length.....	5.30 “
“ “ breadth.....	3.00 “
Color of eyes—brown.	
Color of hair—black, profuse.	
Temperature 99 (underneath tongue); pulse 84, normal; respiration 24, normal.	
Tongue—clean.	
Dentition—complete, save the wisdom teeth.	
Denture—good.	

Special Anthropological Signs.—Right helix flattened; high roof of the hard palate.

Organs of special senses—all right.

Reflexes—patellar reflexes considerably diminished.

Irideal about normal.

Is very little ticklish.

Motor functions—normal.

Secretions and excretions—nothing unusual, except that she sweats easily.

Internal organs—healthy.

Psychically:

Looks somewhat gloomy; brightens up or smiles but seldom.

Disposition mild, affected by her distemper.

Tendencies—girlish, is somewhat impulsive.

Intellectual qualities—average, not completely developed; unstable, weakened whenever she has headache or vertigo.

Memory—often weakened.

Moral and æsthetic sentiments about normal.

No fixed ideas, morbid fears, hallucinations or perversions.

(Photographs not obtainable.)

MARIA.

Height 1.485 m.; arm expanse 1.495 m.; weight 124 lbs.

State of nutrition—fair.

State of blood supply—good.

Skin—healthy.

Color of eyes—grayish blue.

Color of hair—black, quantity profuse.

Temperature 99 (under the tongue); pulse 90, small; respiration 28, short.

Tongue—clean, no deformity. (See under motor system).

Denture—good; gums normal.

Hard palate—roof very high.

Scars—an old scar on frontal part of the head, to the right of the median line, just above the insertion of hair; height 7.5 mm.; breadth, 2 mm.

No deformities. No special marks.

Special Anthropological Signs.—Low forehead; whole head subnormal; facial asymmetry; deflection of uvula.

Measurements of Head:

Circumference—max.....	52.5 cm.
Nasion-inion.....	31.4 "
" ophryon.....	1.7 "
" bregma.....	13.0 "
Supraauric. points—forehead.....	27.1 "
" " insertion of hair.....	28.7 "
" " bregma.....	31.2 "
" " max	33.5 "
" " inion	27.0 "
" " chin.....	29.6 "
Diam. antero-poster.—max.....	17.2 "
" lateral " 	14.1 "
Form of the head—subbrachycephalic (Broca), index..	81.9 "
" " " biauricular diam.....	11.7 "
" " " frontal minim.....	10.2 "
" " " bimalar.....	10.0 "
" " " bigonial.....	8.3 "
Face—height.....	11.9 "
" forehead (nasion—ins. hair).....	4.8 "
Nose—length.....	5.05 "
" breadth.....	3.12 "
Nasal index—61.7; leptorrhynian.	
Eyes—separat. of extern. canthi.....	9.65 "
" " " intern. " 	3.55 "

Ears—left, length.....	5.45 cm.
“ “ breadth.....	2.82 “
Ears—right, length.....	5.45 “
“ “ breadth.....	2.75 “
Lips—expanse.....	1.70 “

Organs of Special Sense:

Eyes—not strong, near-sighted (statement). Pupils normal.

Hearing—good (test). Ringing in ears (several times a week).

Smell and taste—nothing abnormal (statement).

Sensibility—limit of tactile sense right cheek, little above 1 cm.; on left cheek 1 cm.; on external surface of forearms, 4.5 cm. No marked differences in any place on the two sides of the body.

Reflexes—patellar increased, no clonus, cutaneous and subcutaneous diminished—no tickling sensation produceable under chin, in axillas, or on the soles of the feet.

Irideal—about normal.

Motor system—eyelids on being closed continually tremble. (Examined for same and found same before). They also twitch often whilst open. Occasional twitches of facial muscles. Fingers steady. Tongue, marked deviation to right, (also ascertained at previous examination).

Right side of face in state of paresis; right extern. canthus lower, giving the eye a Mongolian appearance; the whole right cheek somewhat baggy and lower; the right corner of lips moves much less than the left from median line when subject smiles.

Other muscles all right

Secretions and excretions—nothing abnormal.

Internal organs—healthy, no gynecological disorder (statement). Not pregnant.

Holding of the body—loose, head more or less bent down.

Expression mostly sad, now and then mild and nice.

Look—guiltless, unaffected, frank, steady without any special struggle, somewhat frightened.

Behavior—meek, natural, unforward, considerably passive.

Condition of sleep—sleep mostly light. Many dreams, many times unpleasant—will be escaping from fire, see cats, especially one black, which runs around and sometimes wants to hurt her, etc., or will feel choking weight on the upper half of her body. Vertigos at night (see anamnesis). On awakening, head seldom feels all right.

Psychically:

Disposition—gentle, affectionate, but much subject to dejection and crying spells; never much vivacity or any special hilarity or brightness. Not subject to passions. Very naïve.

Very religious, though not bigoted.

Tendencies normal, pacific, unselfish.

No impulses as long as in normal state.

No fixed ideas.

Intellectual qualities—average; very little idealism or fancy. Is sensible, appreciative, comprehends well, but is throughout simple and rather slow; not much of intellectual resource.

Psychical endurance—not strong; examination tires her.

Psychical sensibility good, responds easily to emotions; is bashful, psychical impulses re-act with no exaggeration. Comprehension limited.

Self-control—fair.

Memory—good when given time, and especially when she is alone or with persons to whom she has become accustomed; at times unreliable.

Desires—weak. Regrets—none real, but much sorrow. Good sense of propriety, duty and honor.

Moral sentiments—present. Is grateful.

Æsthetic sentiments—ordinary.

No perversions determinable. (Figs. 15—19.)

M.'s signature—

*Yours friend
Maria Barbella*

THE AVERAGE MEASUREMENTS OF TWENTY ORDINARY FEMALE CALABRIANS.

(All from Ferrandina, Italy.)

AGE.

Average of the 20—28 years.

Maria.

Seriation—17 to 20 years.....	3;	
20 to 25 years.....	5;	24 years.
25 to 30 years.....	5;	
30 to 35 years.....	2;	
35 to 40 years.....	3;	
40 to 43 years.....	2.	

FIG XV

STATE HOSPITALS BULLETIN.

FIG. XVI.



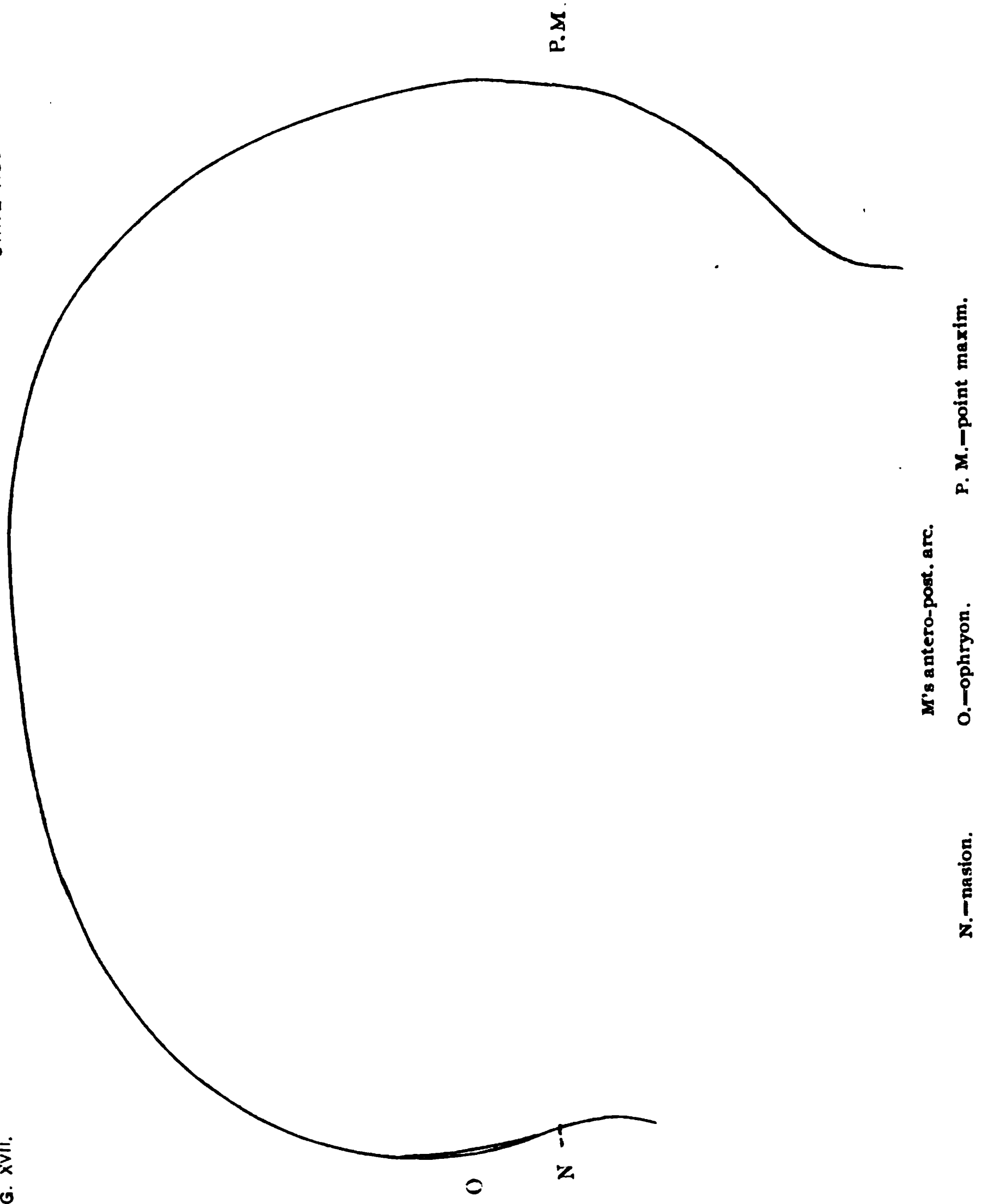
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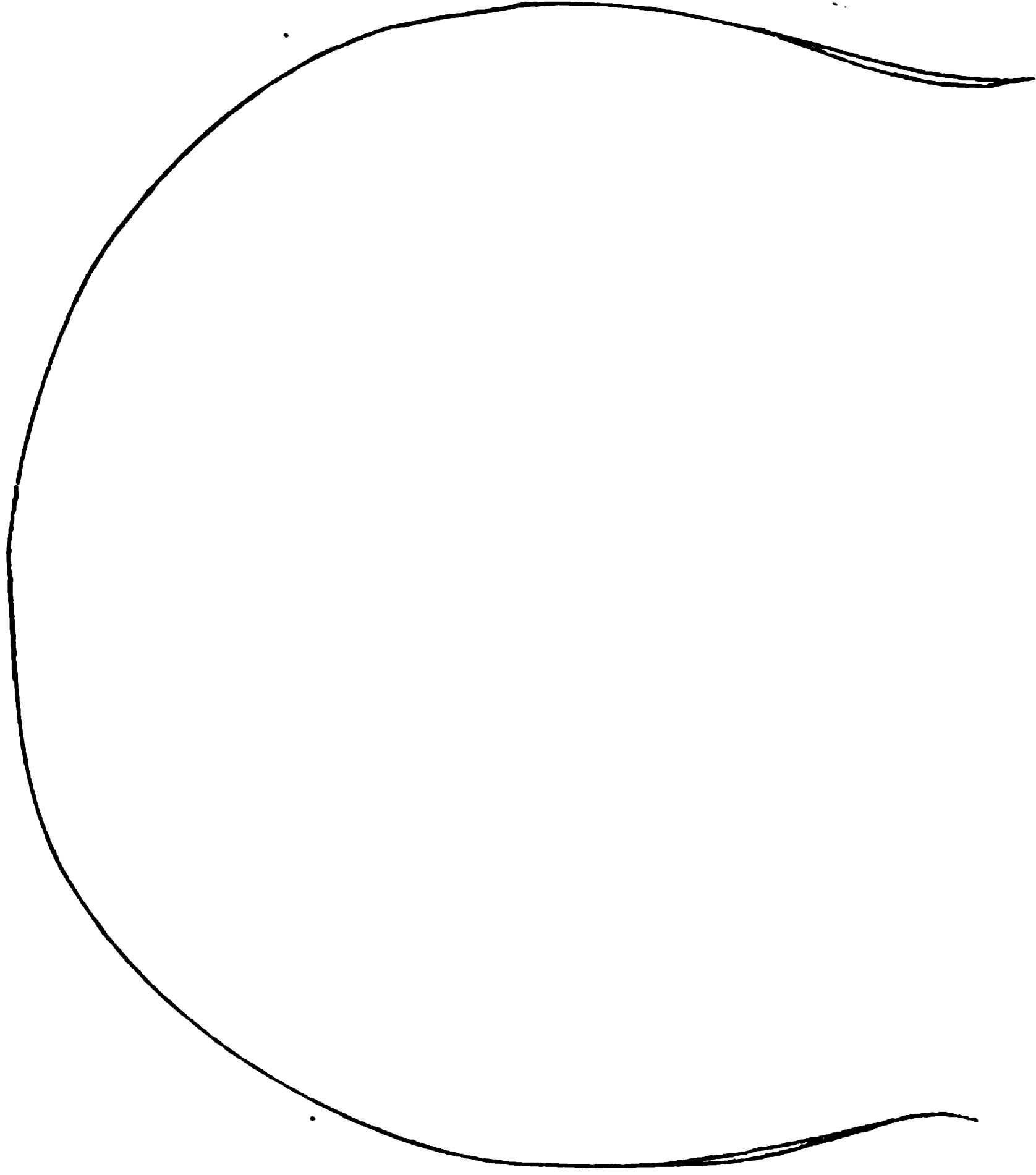
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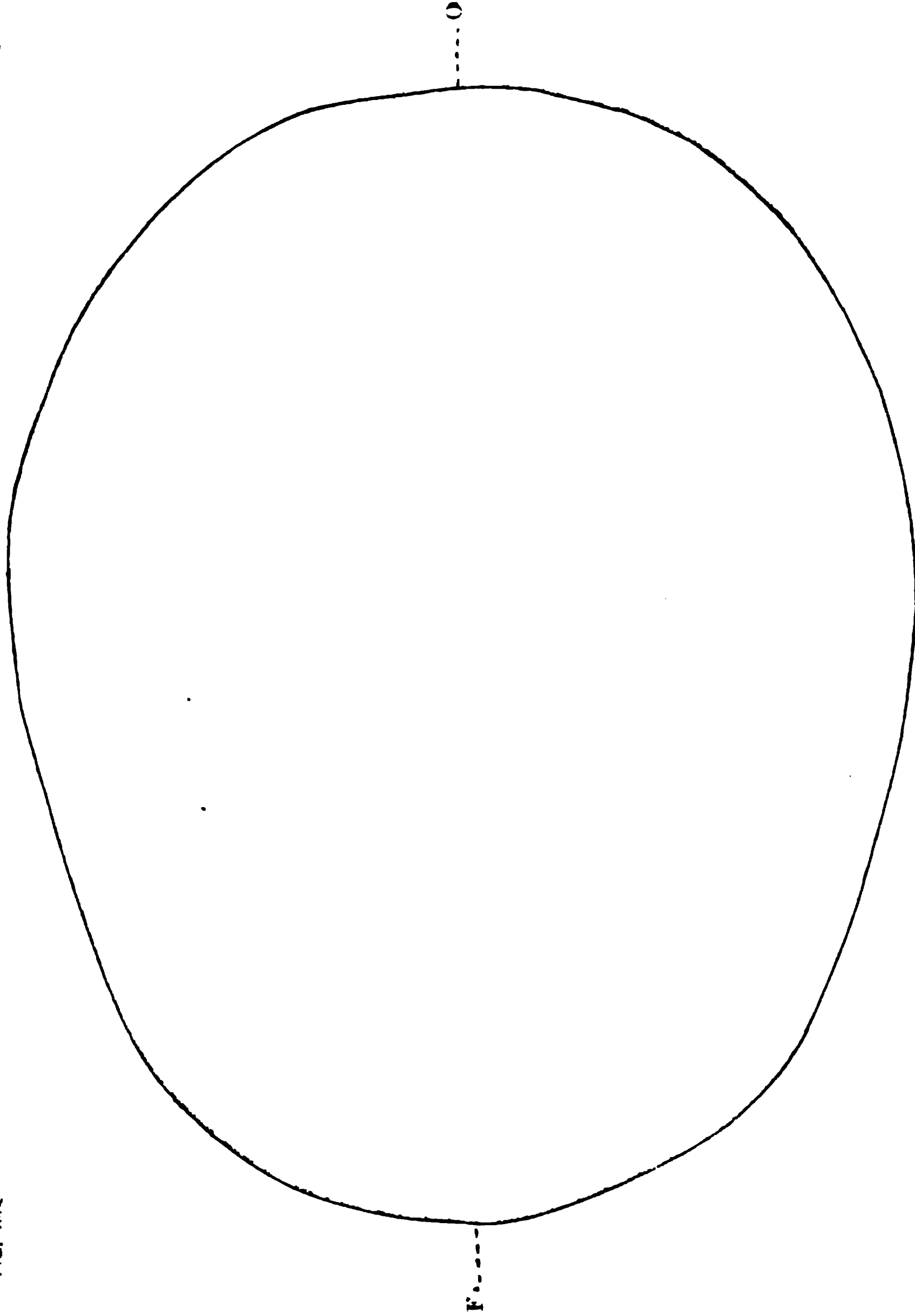


FIG. XVII.





M's lateral arc. (From supraauricular points.)



M's circumference, max. arc.
F. = front O = occiput.

HEIGHT.		
Average—1.535 m.		
Seriation—1.42 to 1.45.....	2;	Maria.
1.45 to 1.50.....	2;.....	1.485 m.
1.50 to 1.55.....	8;	
1.55 to 1.60.....	6;	
1.60 to 1.66.....	2.	

CIRCUMFERENCE MAX. OF HEAD.		
Average—53.8 cm.		
Seriation—52.2 to 53.....	3;.....	52.5 cm.
53.0 to 54.....	10;	
54.0 to 55.....	4;	
55.0 to 56.....	3.	

COMPARISON AS TO AGE AND HEIGHT.				
Age—(a) 20.	Circumf....	53.0 cm.		
“ (b) 21.	“	53.4 “		
“ (c) 21.	“	53.5 “	Maria, 24 years—Circumf.	
“ (d) 22.	“	53.5 “		[52.5 cm.
“ (e) 24.	“	53.0 “		
“ (f) 25.	“	56.0 “		
Height—(b) 1.42	“	53.4 “		
“ (g) 1.43	“	52.3 “		
“ (d) 1.495	“	53.5 “	Maria, 1.485, circumf.	
“ (h) 1.495	“	53.0 “		[52.5 cm.
“ (i) 1.50	“	53.5 “		
“ (j) 1.50	“	53.7 “		

SURFACE MEASUREMENTS.		
NASAL POINT—EXT. OCCIP. PROTUB. (NASION-INION).		
Average—32.8 cm.		
Maria.		
Seriation—30.5 to 31.0.....	1;	
31.0 to 31.5	2;.....	31.4 cm.
31.5 to 32.0.....	1;	
32.0 to 32.5.....	1;	
32.5 to 33.0.....	3;	
33.0 to 33.5.....	7;	
33.5 to 34.0.....	3;	
34.0 to 34.5.....	2.	

NASAL POINT—BREGMA.		
Average—13.45 cm.		
Maria.		
Seriation—11.3	1;	
12.0 to 12.5.....	4;	
12.5 to 13.0 incl.....	2;.....	13.0 cm.
13.1 to 13.5.....	1;	
13.5 to 14. incl.....	5;	
14.1 to 14.6 incl.....	7.	

SUPRAAURICULAR POINTS—FOREHEAD.		
Average—26.68 c. m		Maria.
Seriation—24.2	..... 1;	
25.5 to 26.0.....	1;	
26.0 to 26.5.....	4;	
26.5 to 27.0.....	8;	
27.0 to 27.5.....	2;.....	27.1 cm.
27.5 to 28.0 incl.....	4.	

SUPRAAURICULAR POINTS—BREGMA.		
Average—30.95 cm.		Maria.
Seriation—28.3 to 30.0.....	2;	
30.0 to 30.5.....	4;	
30.5 to 31.0.....	4;	
31.0 to 31.5.....	5;.....	31.2 cm.
31.5 to 32.0 incl.....	4;	
34.0	..... 1.	

SUPRAAURICULAR POINTS—MAXIMUM.		
Average—33.7 cm.		Maria.
Seriation—32.3 to 33.0.....	4;	
33.0 to 33.5.....	3;	
33.5 to 34.0.....	8;.....	33.5 cm.
34.0 to 35.0.....	2;	
35.0 to 35.5 incl.....	1;	
36.8	..... 1.	

SUPRAAURICULAR POINTS—CHIN.		
Average—30.18 cm.		Maria.
Seriation—27.8	..... 1;	
28.1	..... 1;	
29.4 to 30.0.....	4;.....	29.6 cm.
30.0 to 30.5.....	5;	
30.5 to 31.0.....	5;	
31.0 to 31.5.....	3;	
31.5 to 32.3 incl.....	1.	

DIAMETERS—ANTERO—POSTERIOR MAXIMUM.		
Average—17.826 cm.		Maria.
Seriation—17.2 to 17.5.....	4;.....	17.2 cm.
17.5 to 18.0.....	10;	
18.0 to 18.5.....	3;	
18.5 to 18.8 incl.....	3.	

LATERAL MAXIMUM.

Average—14.435 cm.

Maria

Seriation—13.8	.....	1;	
14.0 to 14.5	.....	12;	14.1 cm.
14.5 to 15.0	.....	5;	
15.2	.....	1;	
15.9	.....	1.	

CEPHALIC INDEX (Broca).

Maria.

Subdolichocephalic—(75.01-77.77).....	4;	
Mesaticephalic.....(77.78-80.0).....	1;	
Subbrachycephalic..(80.1 -83.33).....	11;	81.9
Brachycephalic.....(83.34 and above).....	4.	

BIAURICULAR.

Average—12.78 cm.

Maria....11.7 cm.

Seriation—12.0 to 12.5.....	6;
12.5 to 13.0.....	7;
13.0 to 13.5.....	5;
13.5 to 13.9 incl.....	2.

FRONTAL MINIMUM.

Average—10.93 cm.

Maria.

Seriation— 9.82	.....	1;	
10.0 to 10.5.....	13;	10.2 cm.	
(10.0 to 10.2 incl., 2,			
10.21 to 10.5, 11).			
10.5 to 11.0.....	4;		
11.0 to 11.5.....	2.		

BIMALAR.

Average—10.72 cm.

Maria.

Seriation—10.0 to 10.5.....	6;	10.0 cm.
10.5 to 11.0.....	8;	
11.0 to 11.5.....	5;	
11.9	.....	1.

BIGONIAL.

Average—9.88 cm.

Maria, 8.3 cm.

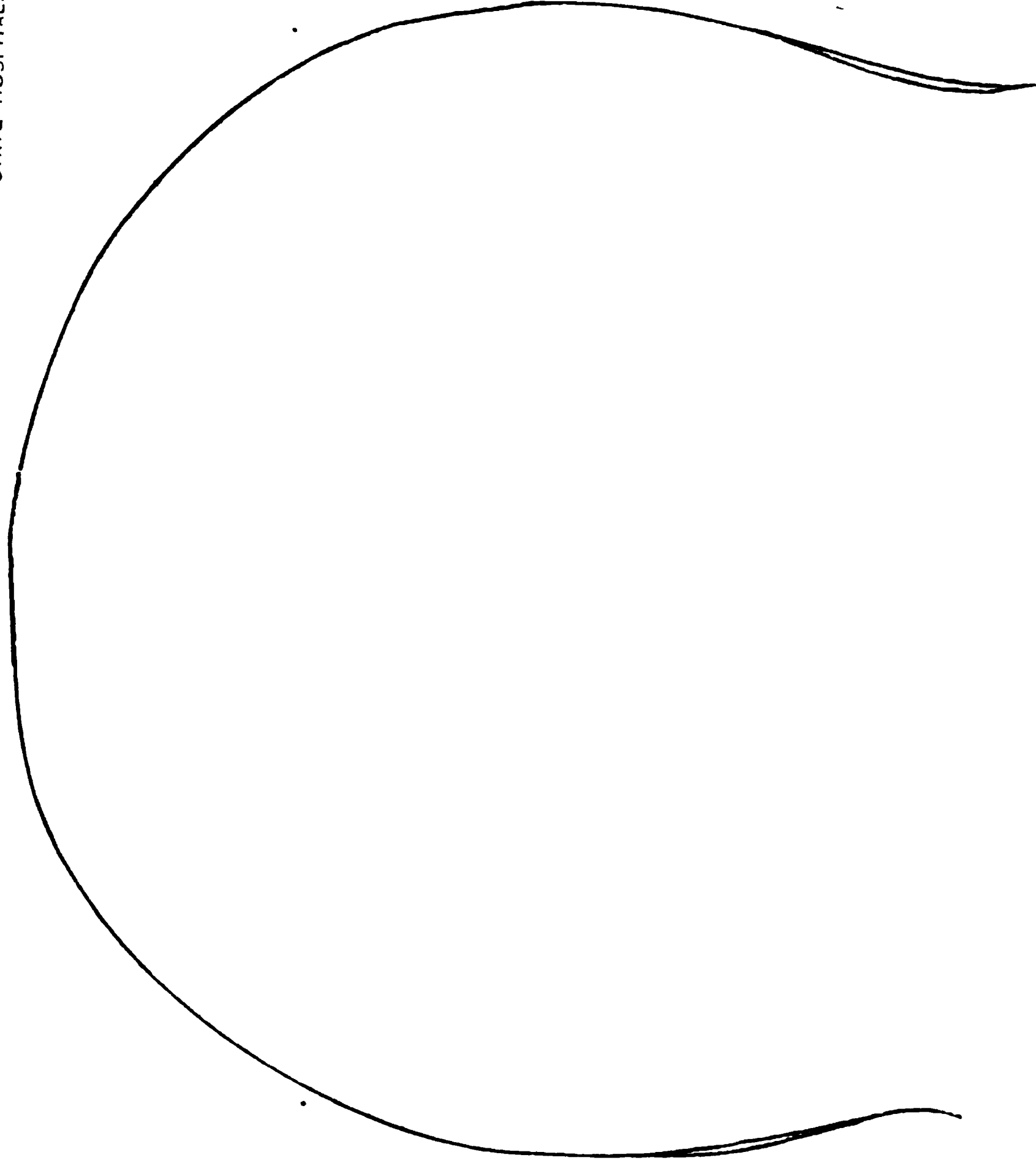
Seriation— 9.0 to 9.5.....	3;
9.5 to 10.0.....	7;
10.0 to 10.4.....	10.

FACE—CHIN TO HAIR-LINE.

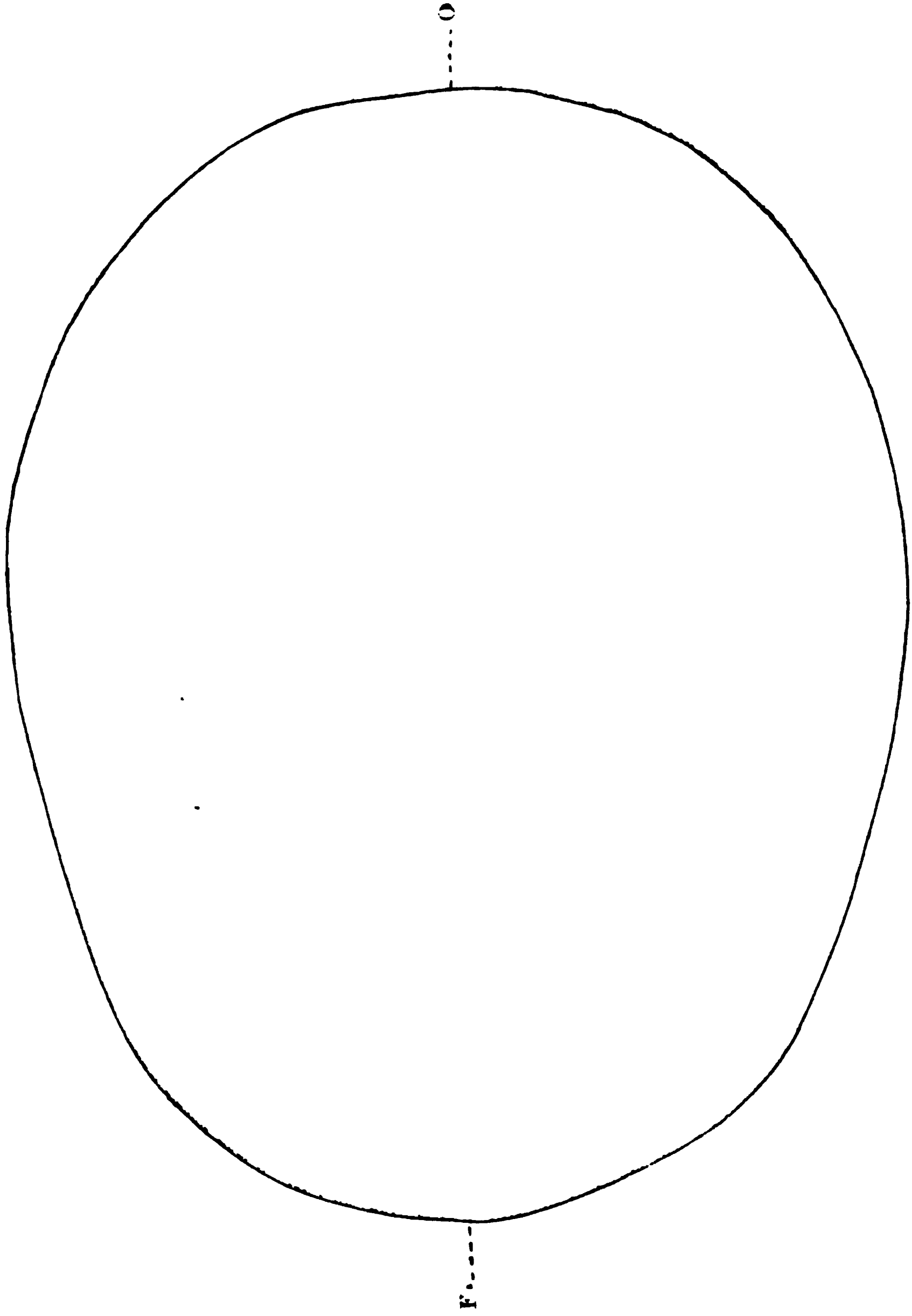
Average—17.37 cm.

Maria.

Seriation—16.0 to 16.5.....	2;	
16.5 to 17.0.....	2;	16.7 cm.
17.0 to 17.5.....	5;	
17.5 to 18.0.....	10;	
18.5	.....	1.



M's lateral arc. (From supraauricular points.)



M's circumference, max. arc.
F. = front O = occiput.

Sometimes the signs of the morbid inheritance appear in members of the family other than those of the direct generic line; in such a case the morbid principles may be latent in the person of the direct line, and we have what we call a cross-inheritance.

As to indirect predisposition, or a predisposition which is augmented or caused by other troubles to which the inclination was more direct, we find this to be also frequent. I can again cite here Gowers (*Dis. of Nerv. Syst.*, '95, V. II, p. 731): "A strong predisposition to the disease often exists when there is defective general development of the brain, from any influence acting on it in early life, or as a result of the congenital defect met with in neurotic families."

In M., we have certainly a mixed predisposition that may cause epilepsy, and a predisposition of a serious character; in addition, in all probability, we have in M. a similar crossed predisposition, for her paternal uncle was apparently an epileptic, and we have an indirect predisposition. We know that M. suffered from infantile eclamptic seizures of some sort, and from malnutrition and a retardation of the normal development. The two last named are much similar to, if not identical with, rachitis; and infantile eclampsia with rachitis is one of the most frequent conditions which an epileptic tendency follows. Gowers says (*Dis. of Nerv. Syst.*, '95, V. II, p. 732) that: "Of the cases (of epilepsy) that commence in infancy, at least three-quarters date from infantile convulsions, ascribed to teething. Such convulsions are known to be the result in most instances of the condition of defective development termed rickets."

And Savage states (in his article on Epilepsy and Insanity in Tuke's *Dict. of Psych. Med.*, p. 452): "In children of neurotic parents it is common to meet with unstable nervous system, which seems to be ready, at the least provocation, to start with convulsions, so that convulsions in infancy are specially common in such families—these convulsions may be the starting point of

true epilepsy." . . M., we know, suffered from infantile convulsions from when two months old to three years and occasionally after, and she also suffered with some form of malnutrition and retardation, and these conditions could not have been without some influence on her faculties in the future.

M. had a sufficient predisposition to have epileptic tendencies—has she manifested such tendencies in any manner throughout her life, has she shown any signs of her special morbidity in her mental or general functions, and does she bear any traces of her abnormal condition in her physical structure?

Epileptic Character.—One of the earliest and most regular results of an epileptic condition in a being is a modification of character. No epileptic is what he was or would be in his normal state; and the changes are regularly great enough to be detected without much trouble.

It would be difficult to say exactly what constitutes the epileptic character. The changes wrought by the morbid condition are not the same in every person, but seem to differ somewhat with the form the disease assumes, according to the more pronounced characteristics of the subject's mental life previous to the invasion of the disease, and probably also according to the inborn faculties of each person. The most frequently found mental changes according to Cividallo, Bianchi and Tonnini (Lombroso's *L'Homme Crim.*, p. 597) were:

Limited intelligence	in from 30 to 69 per cent of epileptics.
Feeble memory	" " 14 to 91 per cent " "
Irascibility	" " 30 to 100 per cent " "
Religious excesses	" " 14 to 100 per cent " "

Savage, speaking about mental deterioration and peculiarities in epileptics (*Art. Epilepsy and Insanity*, Tuke's *Dict. of Psych. Med.*, p. 455) remarks that they "All occur in epilepsy, especially irritability, impulsiveness, defects of memory, especially of recent events." "Another special character is strong religious tendencies." And

further on, speaking mainly about childhood, this author says: "Epilepsy is a common cause of mental enfeeblement in childhood." It is only in adults, who are otherwise healthy, that the disease, in the opinion of this writer, may occur for many years without any marked mental degeneration.

For Krafft-Ebing (*Psychiatrie*, '93, p. 512), the main symptoms of an "Epileptic character" are "eine abnorme Gemüthsreizbarkeit, ein launisches, in Extremen zwischen psychischer Depression (Morosität, hypochondrische Verstimmung mit und ohne Zwangsvorstellungen, geistige Apathie, Abspannung, Befangenheit bis zu Angst bei ganz gleichgültigen Handlungen, Verstimmung, Aengstlichkeit) und zwischen Exaltation mit krankhaft gesteigertem Wollen sich bewegendes, vorwiegend aber misstrauisches, Verschlussenes, dusteres, bizarres, unbegreifliches, launisches, verletzliches, eigensinniges Wesen."

Féré, (*Les Épilepsie*, etc., '90, p. 153), says:

"In general the psychical troubles of epileptics present a character of sadness, which often as a consequence gives rise to reactions of a violent and aggressive character." Besides this there is an array of symptoms similar to those mentioned in preceding quotations.

Voisin (quoted by Lombroso, *L'Homme crim.*, p. 596), goes finally so far as to assert that "La distinction des épileptiques ou fous et non-fous est un sophisme sans aucun appui pratique."*

In fact, there is no author on epilepsy who would not point to the changes of character in the epileptics, yet not all epileptics must of necessity present all the mental changes mentioned, and, in fact, they do not. There are many cases in which the only changes apparent are increased religious sentiments, for instance, or a somewhat irregular, now and then unreliable memory, or an unusual

* This assertion is probably too sweeping when we bear in mind the general conception of insanity; but the fact is that of all the epileptics the writer of this article ever thoroughly examined, there was no case in which the mental powers would not be, here or there or now and then, imperfect.

irritability at times, or seemingly causeless spells of depression, or some hypochondriasis. I have seen cases in which the only apparent mental changes were a disposition to tell untruth, or an increased egotism, or the appearance of hypocrisy, etc. Nevertheless, most epileptics with the morbid condition of a longer duration, and all epileptics with the inborn or early acquired tendency to the disease, present a complex of mental changes, a complex often sufficient to give us the first indications in diagnosing the condition.

The kind of epilepsy does not seem to make *much* difference; we find mental changes in all the varieties; if anything, these changes are more pronounced and more lasting and serious in those who suffer from the minor forms of the disorder.

Does M. present any of the above traits of character, which traits might possibly indicate that she was and is an epileptic of some order?

M.'s mental powers are certainly not entirely normal. First of all she lacks in mental acuity. She had no benefit from school. As a worker she is neat and patient, she is capable of a little fancy-work; but wherever employed, she has never risen in her toil above the simplest stages. She learned some English and some writing and reading during her fifteen months at Sing Sing, showing that she is not destitute of some talent in certain directions; but she has never arrived, even up to now, at a clear comprehension of her case and many things that have happened to her in connection with it; she has not appreciated her condemnation at the first trial, and she has appreciated her release at the second trial just about as a bird would when set free from an ugly seclusion.

Moreover, M. can not even be made to understand that she is a victim of anything abnormal—she sees the same occurrences she is subject to all around her in her family, and if you should tell her she is an epileptic, she will start to cry and will vehemently proclaim she has no “*elipepsy*,” and never had any.

M.'s household is one of the most simple imaginable, and there is no taste visible in either the choice or the arrangement of its little decorations. M.'s dresses fit her, and she is clean and her hair is fixed suitably; but there is no second young woman who has been born in a city and has lived for several years in New York, as M. has done, who would be as naïve in her behavior. In disposition, M. is childish, mild, and inclined to be cheerful, but she will be subject to spells of uncontrollable anger now and then, sometimes on but a very slight provocation, and she also is subject to still oftener spells of apparently unmotivated dejection, even when free from trouble. As to faith M. does not understand much about it; yet she is, and was even more at times during her life, very religious, if not bigoted.

M.'s memory serves her usually well enough, but there are times, and they are quite frequent, when she either can remember nothing, or when her recollections are unreliable; she does not know "what is the matter with her" at such times. M.'s imaginative powers are very restricted. She follows far more her instincts than reason. Her ambitions and desires are weak; she does not care for enjoyments, she has never had the slightest inclination to dancing and has not learned it; she will gambol like her little sister, and a band of street musicians, or an organ, is to her as much, if not more, than the grandest concert by the best musicians. She has strong, animal-like affections.

Here is a group of M.'s little deficiencies and irregularities: Does it show the epileptic tendency in her? It does not *prove* such a tendency, no group of peculiarities could alone decide such a question; but there are two things which this group of M.'s qualities shows plainly: the one thing is, that M.'s mind is not normal; and the second is, that the abnormalities which we observe in M.'s mind are far more such as we should look for or expect in one with the epileptic taint, or an imbecile, than such as we should expect to find in a homicide criminal.

Suicidal Tendency in Epileptics.—Close to the changes of character in epileptics, is there tendency or liability to suicide in these patients? I use the term *liability* because suicide in epileptics in probably most of the instances is nothing but one of the incidents of their morbid condition. The various authors on epilepsy have well recognized this suicidal liability of the subjects of the disease. Lombroso, among others, gives this point his attention; he says (*L'Homme Crim.*, p. 601): "The tendency to suicide in epileptics is frequent; sometimes it is sincere, often simulated, and more often still automatic."

We have several apparently automatic suicidal attempts with M. (*Vide* anamnestic data).*

Physiological Derangements.—The epileptics suffer also in other functions besides their mental ones; their ordinary physiological life is affected in various manners. This particular field of physiological derangements in epileptics is not, however, sufficiently investigated as yet; we have no physiological complex corresponding to the "epileptic character." Nevertheless certain facts seem to be established and I shall include a few in personal observations.

Ch. Féré teaches us (*Épilepsie*, B. O. Aide. Mem., p. 75), that the most frequent physiological disturbances in epileptics are derangements of nutrition and intestinal troubles; the blood is often poor in hæmoglobin; respiration is often defective, the capacity of lungs diminished, the muscular energy is frequently weaker than that in normal individuals, and there are frequent troubles of general sensibility and of some of the special senses. In addition to this I think we ought to mention disorders of sleep, terrifying and particularly motor dreams (dreams of fires, fighting, wild animals, cats, of falling from height, of rising or floating, etc.); frequent headaches, especially of sharp, pin and needle character; changes in the urine, particularly in its specific gravity; disturbances of the sexual functions, very frequent increase or again a great diminution in

* The discrimination of the impulses is not of such a weight as may seem at first, for the reason that they every one require a cause of certain morbidity.

patellar reflexes; frequent tremor of eyelids on their closure; and a very common absence of the sensation and reflexes of tickling. Of the special senses I have found the *smell* absent or much diminished most often; and as to the higher functions, there are very frequently disturbances of speech.

In M. we have a delayed speech (*vide* anamnesis); the bad sleep and bad dreams, a constant tremor of eyelids on their closure (determined on several distinct occasions), increased patellar reflexes, and absence of all tickling sensation.

Anatomical Abnormalities.—Do epileptics differ also anatomically from other people? According to many reliable observations such would seem to be the case.

As to stature, Lombroso finds among 410 epileptics—

202 of the average height.

106 below average height.

102 above average height.

As to the weight of epileptics we are not certain, but if we could judge from the abundance of scrofula and phthisis among the epileptics, we should expect their weight to be below the normal.

Facial and cranial asymmetries are frequent among epileptics (Laseque, Amadei, etc.) Other cranial abnormalities are encountered more often among this class of people than among the normal.

Lombroso found a low forehead in 9 per cent of male and 3 per cent of female, and Cividalli in 9 per cent of female epileptics.

Small cranial capacities also predominate among epileptics according to Lombroso (L'Homme Crim., p. 585): "Although among epileptics there are individuals who are healthy, robust, of good stature, and at times even athletes, nevertheless the average cranial capacity is below that of the insane (this is so at least for males whose average cranial capacity is 1479 c.c. while that of the females is 1358 c.c.) In epileptics the two extremes of cranial

capacity can be detected—the exaggerated type of capacity (this is found in a very small number of cases) and the type of diminished capacity which predominates.”

According to Benedict (*Anthropometrie Crainocéphalique*, p. 73), the nasion-inion arc and particularly the bregma-obelion distance are smaller in epileptics. The same author mentions also the inferiority of the bilateral diameter in these subjects.

Examined in 50 epileptics and in 110 healthy persons, this biauricular diameter gave me in the former the mean of 12.40 cm., and in the latter the mean of 12.60 cm.

Other anatomical parts than those of the head seem to differ in the epileptics, but here we must begin with further examinations.

M. shows us the following anatomical abnormalities: She is of a subnormal stature, almost all the measurements of her head are subnormal, or inferior to similar measurements obtained on a sufficient number of a similar class of her countrywomen; the forehead of M. is particularly low, the distance from the nasion to the crinion, or hair point, being only 4.8 cm., and the biauricular diameter is also very small. M. has some asymmetry of the face (independent of the paralysis); and she has a high palate. (Body and limbs could not be examined).

Facial Paresis.—In addition to the above enumerated mental functional and structural abnormalities, we find in M. several other manifestations which approximate her still more to an epileptic. We have in her case a partial paralysis of the muscles of the right side of the face, same side of the tongue, and, possibly, of the opposite azygos uvulæ; this paresis is apparently old, as it was never noticed by any one, not even by M. herself, but it is not congenital paresis, as the affected parts and particularly the tongue, show no marked atrophies of the muscles. The origin of this paresis is most probably central, for no muscles are involved in it above those of the lower eyelid, and a careful search fails to disclose any other cause.

I do not know, and can not find out in literature, how

much of an indicative or of a corroborative sign of epilepsy a facial paresis of central origin may be; but this is not the first time that I have encountered this condition with epileptics, and further researches may show that it has a certain signification. By all means, a persistent facial paresis (the condition lasts still, unchanged, five months after I have seen it first) in a young woman of twenty-four, in a woman who has never passed any serious affection since her infancy outside of a seemingly mild attack of small-pox about ten years ago, would always indicate that something regarding the nervous centres in this subject must be abnormal.

Headaches, Vertigos.—Frequent headaches and vertigos are two more of the unclassified symptoms which M. presents.

Frequently recurring, mostly frontal or bi-temporal, headaches, especially those of sharp nature, certainly have their significance; to be convinced of the importance of these headaches we only need to examine large numbers of different epileptics, and compare the results with those obtained in other classes of persons on inquiries concerning this subject; but the truth is that we can not as yet properly interpret the meaning of these headaches.

As to vertigos, we know something more about them than about the cephalalgias. We know especially that recurring vertigos, particularly those of the objective variety, if not due to an eye or an ear disorder, have always a serious significance in regard to the state of the central nervous system; and we know in particular, and that even before Tissot, Esquirol and Moreau du Tours, that the vertigos of central origin bear a common relation to epilepsy.

There are epileptics who deny ever having felt any sort or degree of vertigo. Epileptics with nocturnal attacks only are sometimes free from, or perhaps rather unconscious of, the symptoms. With the majority of epileptics, however, vertigo is a common concomitant of the other signs of the disorder; in some cases it is

the most important manifestation, and exceptionally the only important manifestation of the morbid condition. For Magnan (*Leçons Cliniques*, '93, p. 22) says: "Vertigo is a frequent manifestation in the neurosis in question (namely epilepsy); at times it is in fact the only manifestation." And I would cite words to the same effect from almost every noted writer on epilepsy. Esquirol taught that vertigo is not only a common symptom with the epileptics, but, furthermore, thought that frequent vertiginous attacks have a particularly perturbing influence on the mental powers of the sufferer. And Lombroso, finally, goes so far (*L'Homme Crim.*, p. 623) as to assert that "All those forms of impulsive accesses which we denominate criminal, are much more frequent in epileptics who suffer only from vertigos."

The vertigos in M., we have seen, are very frequent, and these spells can be ascribed to no sufficient disorder of the organs of sight or hearing; commonly there is an absence with M. of even such a secondary cause of dizziness as are indigestion, or sudden changes of posture.

Tics.—M. presents another little group of symptoms, of which it will be well to speak a few words in this place, although the fact has been already mentioned. There is a constant tremor of M.'s eyelids on their closure; and there are occasional "tics" or small, sudden and brief contractions of her eyelids or facial muscles.

These symptoms are nothing uncommon and occur in many neuropathic conditions, they occur even in normal persons in debility, but they seem to be particularly frequent with epileptics. According to Féré (*les Épilepsies, &c.*, '90, p. 387): "The frequency of tics of the facial muscles has been signalized by all the authors." And Tonnini found nictitating eyelids in 8 per cent of male epileptics (quoted by Lombroso, *L'Homme, Crim.*, p. 587).

This brings us to the analysis and consideration of such of M.'s manifestations as might be due more directly to an epileptic tendency.

M.'s Seizures.—We have seen that M. had, outside of the eclamptic seizures of her infancy, several attacks in her life, which attacks were closely similar to major attacks of epilepsy. Two such seizures have been ascertained in M.'s childhood, one when she was four and one when she was ten years of age, and there is at least one such instance afterwards, namely the one particularly well witnessed attack during her life with Cataldo. Outside of this we have a somewhat hazy history of several smaller seizures—two in the Tombs prison and one at or immediately after the crisis with Cataldo.

The first question that presents itself in regard to all these attacks is, is it probable or is it not probable that they were of an epileptic nature?

In M.'s hereditary taint and in her infantile convulsions, there is enough cause for the presence of an epileptic tendency, but if such a tendency has resulted would not its manifestations have been more frequent? We have several well-pronounced attacks here, but there are intervals of years between them; there is a period of about six years between the first and the second seizures, and a period of about twelve years between the second and the third; is such a condition possible in epilepsy?

Here Gowers tells us (*Dis. of Nerv. Syst.*, V. II, p. 751) that "when the disease is established, the interval between severe fits varies greatly." And Féré (*Les Épilepsies*, '90, p. 117), says that "It is possible to cite cases which have no more than a single attack during their whole life; some pass many years without having any."

These citations demonstrate sufficiently the possibility of almost any degree of rarity of attacks, but there is still another great possibility that makes such a rarity of seizures possible, though then it is only apparently true, and that is the fact that between any two larger there may be any number of misunderstood smaller attacks, and any number of unperceived nocturnal ones. The minor attack occurs, according to Gowers (*loc. cit.*) "in less than half the cases of epilepsy. They may occur alone,

without severe fits, but both kinds are usually associated. The slight seizures are, as a rule, frequent." Whilst nocturnal seizures, according to the same author, "may occur for twenty years without the patient or his friends suspecting the fact." "If an attack occurs during sleep, and its onset does not awaken the patient, he may sleep on when it is over, and be unaware of its occurrence." The only signs often of a nocturnal attack in the morning, are some dulness, headache, crossness, or indisposition.

The minor attacks may consist of nothing but a spell of vertigo, or of a momentary absence, or of a certain impulse; the nocturnal spell may be equally light—and we have some good reasons to believe that something allied to both these forms of seizures happened to M.

Aside from their rarity, M.'s attacks, or at least some of them, have not been exactly classical. In the last attack preceding the crisis with C., there was very little of convulsive movements and there was no tongue-bite nor any micturition; and the two attacks of M. in Tombs appear to have been similarly deficient in these few symptoms. But here again Gowers tells us (*loc. cit.*, p. 760) that "Too much weight must not be placed on the untypical character of the attack, because some epileptic fits may deviate much from the usual type."

When a child M. seems to have had a much more typical spell, for then she "contorted herself," bit her tongue and urinated in her clothes. Perhaps here applies the nice explanation of the changes of convulsive seizures during life from the motor to the more sensory and psychical, which J. Anderson gives us as a quotation from Hughlings-Jackson, in an article on Epilepsies and Insanities (in Tuke's Dict. of Psych. Med., p. 449): "The last evolved part (of the nervous system) is practically synonymous with the most unstable." "The infant's lowest centres are the highest it has got, its last evolved and therefore still unstable." "As evolution goes on, these lowest centres become more and more stable,

less and less liable to discharge." Besides this, Gowers informs us (*loc. cit.*, p. 741), "In some epileptic fits there is but one form of spasm, either tonic or clonic." And where the clonic spasms are absent, we would hardly expect either a tongue-bite or an involuntary micturition.

From this exposure it would seem that there was nothing in the character of M.'s attacks that would validly discredit them of having been of epileptic nature.

Simulation, Hysteria and Epilepsy.—Might not M.'s attacks, or at least some of them, have been simulated, or have been of a hysterical instead of an epileptic nature?

There is much that speaks against M. having consciously simulated any such seizures as she had. The reasons are that M. was too ignorant to simulate anything so complicated as an epileptic attack up to at least six months after her offense and she had no pronounced attack since then, although it might have been much to her benefit at one time had she had one; secondly, M. could have had no interest to simulate epilepsy or anything else before or during her first trial, for the question never came up if her physical or mental condition was or was not normal.

Besides all this, simulants behave differently; they choose their places and their occasions; they take good care that they may be noticed; they know when to remind others of their incidents; and simulants are altogether different characters. Whatever M.'s "fits" might have been, I firmly believe they were genuine morbid seizures.

Hysteria, besides being like a chameleon which may assume under conditions almost any color, resembles epilepsy in some particulars, but it differs from this latter disease in other important symptoms. Already the character of the patients suffering with one and the other of these disorders differs. The hysteric oscillates between extremes—the epileptic, even though also inclined to extremes, keeps more on the downside of the level, he shows much lesser facility of mental transmutations and a lesser degree and a greater stability of emotions. And

while the hysteric is often clever and of acute mental powers, the epileptic inclines almost always to the stupid, or at least simple.

As to the differences in the attacks, I can not do better than give a few tables of such differences, tables elaborated by eminent authors:

Gowers, Diseases of the Nervous System, Vol. II, page 758:

	EPILEPTIC ATTACKS.	HYSTEROID ATTACKS.
Apparent cause.	None.	Emotion.
Warning.	Any, but especially unilateral or epigastric auræ.	Palpitation, malaise, choking, bilateral foot aura.
Onset.	Always sudden.	Often gradual.
Scream.	At onset.	During course.
Convulsion.	Rigidity followed by "jerking," rarely rigidity alone.	Rigidity or "struggling" throwing about of limbs or head, arching of back.
Biting.	Tongue.	Lips, hands, or other people and things.
Micturition.	Frequent.	Never.
Defecation.	Occasional.	Never.
Talking.	Never.	Frequent.
Duration.	A few minutes.	More than ten minutes, often longer.
Restraint necessary.	To prevent accident.	To control violence.
Termination.	Spontaneous.	Spontaneous or induced (water, &c.)

J. M. Charcot and Pierre Marie, Tuke's Dict. of Psych. Med., Vol. I, p. 639:

EPILEPSY.

It appears generally during the first fifteen years of life, and generally the patients have had convulsions in their childhood.

The attack commences suddenly; the patient is thrown to the ground without being able to help it; consequently we find many scars in the faces of old epileptics.

HYSTERIA.

It appears generally at puberty, or during the first years of adult life. It is not preceded by convulsions in childhood.

The attack is preceded by a prodromic stage, by an aura, which allows the patient to take the necessary precautions, therefore scars on the faces of hysterical individuals are rare.

EPILEPSY.

We often hear a special cry at the commencement of the attack.

During the attack the patient does not struggle, or but little; it is not necessary to hold the patient down in bed, as the movements are very restricted.

The patient does not speak, he only sighs or groans.

Frequently involuntary micturition or defecation.

Attacks generally rare, and without any appreciable cause; if they are frequent there is a condition of illness (*état de mal*) with serious symptoms and rise of temperature.

Intellectual weakening is often observed and increases with the number of attacks.

Absence of distinct marks (stigmata) of hysteria. In some cases, however, after the convulsive attacks, narrowing of the visual field may be observed but this is transitory.

Bromides have manifestly a therapeutic action.

HYSTERIA.

No cry or a very feeble one.

The patient struggles with such violence that two or three persons are necessary to hold him down in bed; his movements extend to great resistance.

Frequently the patient utters exclamations or intelligible words; often even actual phrases.

Never, or hardly ever involuntary evacuation.

Attacks may be frequent without the health of the patient suffering in any appreciable manner, and without rise of temperature

No intellectual weakening.

Presence of distinct marks (stigmata) of hysteria; narrowing of the visual field when it exists, is permanent.

Bromides have, so to say, no action, or at least it is much less manifest than in epilepsy.

Sachs, Nervous Diseases of Children, p. 73:

EPILEPTIC ATTACKS.

Loss of consciousness very sudden.

Warning of short duration.

Pupils dilated, do not contract to light.

Pulse unaltered

Tonic and clonic spasms in various parts of the body.

Bloody foam at mouth.

Involuntary passage of urine and fæces.

Prolonged stupor after attack.

FAINTING SPELLS.

Loss of consciousness gradual.

Warning of some minutes before consciousness is lost.

Pupils contracted or unaltered.

Pulse feeble.

No spasms.

No evidence of biting of the tongue.

No involuntary passage of urine or fæces excepting in rare instances.

Recovery prompt after attack.

EPILEPTIC ATTACKS.

Loss of consciousness sudden and absolute.

Warning of short duration.

Pupils dilated

Tonic and clonic spasm.

Eyes turned upward and inward.

Involuntary passage of urine and fæces.

Prolonged stupor.

Attacks at rarer intervals.

Duration of attack short.

HYSTERICAL ATTACKS.

Loss of consciousness not absolute.

The attack often preceded by emotional excitement.

Pupils not dilated.

Tonic rigidity; exaggerated conscious movements; arching of back; excessive noises.

Eyes staring, not turned, sometimes closed.

No involuntary passage of urine or fæces.

Recovery gradual; no stupor; the patient may pass, however, into a trance condition.

Attacks may be frequently repeated.

Duration of attack much longer.

Strümpell, Lehrbuch d: Spec. Path. u. Therapie der inneren, Krank., p. 597:

EPILEPTIC CONVULSIONS.

1—Sudden fall to the ground frequently productive of external bodily injuries.

2—Sudden pallor of the face.

3—Pupils dilated, pupillary reflex absent.

4—Convulsions of the type of cortical epilepsy in the form of jerk spasms. Frequently bites of the tongue.

5—Frequently single initial cry then total loss of consciousness.

6—Duration of convulsive attack seldom longer than a few minutes, succeeded by profound slumber.

7—Suggestive and hypnotic procedures without any effect.

HYSTERICAL CONVULSIONS.

1—Gradual prostration. No external injuries.

2—No striking pallor of the face.

3—Pupillary reflex maintained.

4—Spasms consist of precipitate movements, striking about with the arms and legs, turning about of the whole body and the like. Spasm of respiration. No tongue-bites.

5—Disturbances of consciousness of the kind peculiar to hysteria but no complete loss of consciousness. Spasmodic, continued cries, laughter, weeping and the like. Speech present.

6—Convulsive attack may last thirty minutes to an hour or longer—frequently a precipitate awakening.

7—The attacks may be readily produced artificially through hypnotic or suggestive procedures, or they may be inhibited (pressure upon regions of the body, etc.)

EPILEPTIC CONVULSIONS.

8—Other hysterical symptoms are absent.

HYSTERICAL CONVULSIONS.

8—Other concomitant hysterical symptoms often remain after the attack (hysterical hemianæsthesias, paralyses, contractures, etc.)

That M.'s case inclines in general much more to epilepsy than to hysteria, is, I think, self-evident, after the perusal of the foregoing tables.

M.'s OFFENSE.

M.'s condition having been analyzed in general, there still remains an important point to be considered more in particular, and this is the spell in a part of which, apparently, M. slew Cataldo. Has the action really taken place under the dominance of this spell or attack? Are the phenomena noticed in this spell part of the series of actions which occurred before, during and after the fatal actions? Are they compatible with our notions of epilepsy, and could they have been simply the manifestation of the pathological condition of the nervous centres? Has it been the unconscious and irresistible impulse of morbid, epileptic state of the woman's nervous centres and not her will, which directed the weapon and inflicted the brutal wound? Was M. irresponsible for the murder and were both C. and she only the victims of a manifestation of M.'s morbid whole, the components of which were the results not only of the infirmities of her own life, but also those of the several preceding generations? These questions will best be answered by every reader himself after he has perused this report; I shall restrict myself to an analysis of the various facts we know about this particular spell in which the murder happened.

With all the preceding observations as a basis, the following facts confront us in relation to the particular attack which we are now to consider. We have a being with an absence of that special, stigmatized mental character, which we often meet with in offenders against life. A woman who would manually, and outside of a great

quarrel, kill her seducer, on a momentary provocation, for the sole reason that he would not marry her, if not a fanatical creature, would be a woman who would be haughty, selfish, cruel, revengeful, ugly and fiendish—and M. we know, is not such, and is indeed very far from being such a creature.

Criminal Type.—There is no such thing as a *physical criminal type*, but no one who has examined criminals, and especially murderers, will contest that various physical abnormalities are not only very frequent with these individuals, but also, that these abnormalities are usually of a more pronounced character than the similar ones found in other classes than criminals; besides this the manual slayer shows often an abundance of physical power. In M. we have several anomalies, namely: several subnormal measurements, the asymmetry of the face, the high palate; but no one of these abnormalities is very pronounced, and M.'s physical powers are certainly not above the medium, as is illustrated otherwise by her breakdown during the first trial. M.'s facies is peculiar (*v.* photo.), but none of its traits is hard or cruel.

Intentional Murders.—M. might not be a born criminal, and yet she may have murdered with intent. But why should she then not kill C. at home, where she had perhaps a hundred opportunities, each day—why, instead of that, perpetrate the act in a public place, with C. fully awake and among people who might have easily marred her design, and with a certainty before her of capture? This argument, well considered, will really speak too much against the intention in M. as to the act.

Murders from Passion.—Many murders occur from passion. The Italians are particularly noted for their hot blood and a frequent recourse to weapons in their disputes. (In some parts of Italy women often use the razor or the knife to disfigure unfaithful lovers—but there is no such habit in that part of Italy where M. comes from, namely in Calabria). Such incidents are by no means rare between

lovers. But, when a murder from passion is committed, we witness the following spectacle: There is first of all in most cases either a drink, or long hatred, or jealousy; then comes an accidental occasion and a violent quarrel ensues—and there may have been several similar quarrels before with threats; at the height of the quarrel and that usually in a mutual struggle, one of the participants kills the other, he shoots him, if a pistol is at hand; stabs him, if a knife or a poignard is nearest; he shoots and especially stabs several times in rapid succession and mostly without distinct aims, or, the would-be slayer grabs and injures with anything near by fit to be a weapon.

The deed done, a fright, or an extreme mental misery, or both together, follows; only in very infrequent cases is there a satisfaction, the passion still continuing. As to action of the slayer, one of two things is certain: He either flies from, or he stays with his victim, and in this latter case he either laments over the death of his opponent, or, pale and trembling, awaits the police in order to give himself up to justice.

In M.'s case we have no quarrel, strictly speaking, but only a by no means unusual period of supplication. There is no active jealousy in the case, for C. has no recent love outside of M. The weapon to be used is an unusual one for a woman and especially for one so timid as M. is. There were never any threats of violence as far as known towards C. on the part of M. The only thing the neighbors ever heard was that she would do away with herself. A strong provocation lies in the words "hogs may marry," and it must have aroused an emotion, but we would far sooner expect a new burst of crying or reproaches after such a remark, than an immediate murder, especially as we know that M. received several times before a worse treatment than this from Cataldo.

Hence, although there can be no doubt but that the cynical expression affected M., we know that she had other reasons before to be affected still stronger, and as she did not commit, or try to commit any assault on the former

occasions we must of necessity look at this last time for some additional cause. The particular act of the murder itself in this case is a cat-like act; it is more like a sudden act of a powerful instinct, than like that due to deliberation, with will and judgment.

And after the act, there is nothing but a series of physical and mental blunders, a stretch of confusion, now and then seemingly somewhat interrupted by more clearness, by more lucid moments; and still further, subsequently, there is sorrow, much sorrow for Cataldo, and some for M.'s own family; there is fear of the unknown, the pending, but there is no fear nor even a thought of the awaiting punishment, no emotion on sentence, and never any true regrets. Could we call this particular murder a murder from passion under these circumstances?

Accidental Murders.—A murder by accident M.'s act was certainly not; the almost severed head of C. bears the best witness to this.

Murders Due to Pathological Causes.—It seems, then, in this case that there remains nothing else to think of but a pathological cause of the murder. We know that there is a number of morbid conditions which may, indirectly or directly, or in both ways at once, determine a murder; indirectly by changing their subject's moral powers, emotivity, inhibitiveness, or other mental faculties; directly, by creating, gradually or suddenly, the crime-impulse itself; and in both ways at once, where on one side the resistive or the discriminative powers of the brain are weakened, while at the same time there arises the tendency or impulse to the crime. Insanities of all degrees, especially paranoias, alcoholism, and neuropathies from drug abuse, are examples of such morbid condition which often predispose to or cause murder; but the predisposing and especially determining condition *par excellence* is epilepsy, epilepsy with all its variations.

Epilepsy and Murder.—We have no statistics of the percentage of murders which are due to epilepsy, but

forensic literature is full of such instances; the proportionately large number of epileptics which we find in penal institutions has also some significance.* Crime in general, according to Clark, (*Heredity and Crime in Epilepsy*, London, 1880) occurs in 11 per cent of common and in 3 per cent of traumatic epilepsy, and most of the epileptic crimes are deeds of violence against persons. Blandford (*Insanity*, 191, p. 199) informs us that: "From epileptics we may expect acts of sudden and unaccountable violence, whether they occur in close connection with fits or take the place of, or follow them."

Magnan says (*Lecous Clin.*, '93, p. 3), like Lombroso, that: "Prisoners yield about ten times as many epileptics as normal individuals." And Clouston, speaking of epileptics in insane asylums, is of the opinion that: "There is no form of insanity that, outside of asylums, is more frequently the cause of murders, except perhaps, the alcoholic." (*Mental Dis.*, '96, p. 439). Indeed, this last mentioned author goes so far as to declare (*loc. cit.*) that "a murder by an epileptic should usually be looked on as being as much a symptom of his disease as larceny by a general paralytic."

Different Varieties of Epilepsy and Murder.—Not all varieties of epilepsy are equally often associated with tendency toward murder or predispose to it. We may say in general that those varieties of epilepsy are the most dangerous, in the above respect, which are accompanied by the most frequent mental disturbances; and these are the varieties wherein there occur many minor or incomplete motor seizures, and many more or less brief mental disturbances.

The epileptic who has a severe convulsion with his attack, is a far safer being objectively than one in whom the motor manifestations are slight or altogether secondary to sensory or mental symptoms. When an epileptic

* (Lombroso, *L'Homme Criminel*, page 607): "Les prisonniers donnent environ dix fois plus d'épileptiques que les normaux." (Page 608)—Among 297 criminal epileptics, 76 were homicides.

discharge takes place mostly through the motor centres, the after-effects of the attack are mostly only an exhaustion, which will yield to rest.

But when the discharge takes place more through the psychical areas, there is a mental disturbance established, a mental disequilibrium is produced, which amounts to a greater or lesser temporary insanity, and that abnormal acts take place in such a state of mind is almost natural; that violent and homicidal acts do preponderate in this state, is probably due to the nature of concomitant hallucinations. Krafft-Ebing in his *Gerichtliche Psychopathologie* ('92, p. 224) counts such transitory mental disturbances of the epileptics to the most important complications of the disease. "Sie sind häufig, flüchtig, nach Umständen schwer nachzuweisen, bringen vielfach das Leben der Umgebung in Gefahr und haben deshalb ernste Wichtigkeit für das Forum."

As a consequence of the facts just described, if our subject, M., has committed her act in an epileptic condition, we would hardly expect this condition to have been other than a mixed, or minor attack, with some mental perversion.

How can we diagnose a minor epileptic seizure? Krafft-Ebing (*Gerichtliche Psychopathologie*, '92, p. 219, etc.) gives the following indications:

(1) We are to ascertain first of all if the etiology would in any way authorize the conclusion as to epilepsy. (A sufficient number of etiological factors in M.'s case seems to justify this conclusion).

(2) Previous attacks ought to be ascertained. (We have these in M., both major and minor.) Herewith the author considers of special importance the fact of convulsions in infancy, the occurrences of nightly terrors, and of somnambulism. (We had also all of these in M., except the somnambulism). Still further, the possible nightly attacks should be thought of, and we should give attention to such symptoms in the morning as the wetting of the bed, ecchymoses of the face or the ocular sclera, falls from the

bed (M. had one), wounds of the tongue, headache, confusion, dulness and morosity on awakening. (M. frequently has all these last symptoms).

(3) The diagnostician should differentiate between real attacks and simulation (we have done so already with respect to M.); and the author adds himself, below, that a simulation of a minor attack is very improbable.

(4) In the fourth place, Krafft-Ebing advises us to examine for the usual changes in the character of an epileptic, and for various sensory and other phenomena which are frequent in those suffering with epilepsy. (This we have also already done with M., with a positive result).

As to the minor attack itself, various authors give us specific indications. Thus Anderson (Tuke's Dict. of Psych. Med., p. 450) says: "In cases of petit mal, or minor epilepsy, we have dissolutions of the most various depths." "In minor epilepsy, however slight, there is always defect of consciousness, more or less in different cases, *but never absent*." "The loss may be of all degrees. The point is that there is loss."

For Siemerling (Jahresbericht d. ges. Med. v. 1446, '95), a dreamy state is the most important sign of a minor attack, although all kinds of forms and extent of mental disturbance may occur; these disturbances in the opinion of this author are all signs of the same weight of a brain disorder. These transitory obscurities of mind are characterized by the possible apparently co-ordinated acts, which acts may be violent.

Causes of Petit Mal.—The causes of a minor attack of epilepsy are the same as those of major seizures, and like those they are often obscure and sometimes can not be determined.

Among other causes mental emotion may precipitate an attack. Gowers gives this particular cause a considerable importance. "Mental emotions," in his own words (*loc. cit.*, V. II, p. 732)—"fright, excitement, anxiety—are the most potent exciting cause of epilepsy." Considerable exciting influence is attached by almost all authors to

menstruation in women. "In women (Gowers, *loc. cit.*, p. 752) attacks often occur at the menstrual period." Féré is of the same opinion, and similarly Falret; for Clouston (*Ment. Diseases*, 4 ed., p. 521), "Many purely nervous derangements and diseases such as neuralgia, migraine, epilepsy and chorea, are apt to be aggravated at the menstrual periods or to begin then."

In M., we have several conditions which might have produced an attack; there were several weeks preceding of anxiety and worry, there was menstruation; and there was the final emotion produced by C.'s utterance.

Aura.—Many minor attacks of epilepsy begin with some form of aura, most frequently with a sense of giddiness or with visual phenomena, such as seeing sparkles or flashes of light, of red, green, or white color. (With M. we have a sudden heat in the head, then a flash, and then darkness).

Mental Disorder.—The mental disorder may precede, or follow, or take entirely the place of motor manifestations. The spasms themselves are generally either irregular or limited. At times a mental change precedes an attack of epilepsy (minor or major) by several hours, and then it consists, according to Magnan (*Lec. Clin.*, '93, p. 28), "in a change of character, with heaviness of the head, sadness, inaptitude for work, restlessness, depression, during which the patient at times perpetrates injuries, does violent acts, or, on the contrary, but more rarely, shows a light-hearted and contented mood." Farther on the same author says: "If the intellectual disorder rises above certain limits the act becomes absolutely unconscious."

Maudsley, (*Pathology of Mind*, pp. 483-484), describes one form of the mental accompaniments of epileptic attack as follows: "Consider, for example, the abrupt and dangerous transformation of personality, the thoroughly distempered mood of acrid and sullen feeling, which frequently precedes or follows an epileptic fit, prelude or after-clap of its cerebral commotion, and more often follows an incomplete than a complete attack. Superficially,

the mood has all the look of morose temper, surly suspicion, crabbed irritability, and violent passion, but it may really denote a strange anguish and intolerable unrest urging or driving the patient to unburden himself of its load at any cost, or it may mean a distracting impotence, indescribably distressing, to collect his ideas, to feel his being, to realize himself, or it may cover an awful broil of horror and suspicion. It is out of such sullen ferment of acrid emotion that violent and destructive outbreaks against persons or things either precipitate themselves abruptly or take the slower sequence of premeditation and planned effect." To which I may add the statement of Gowers, that "In rare cases there are considerable mental changes, even with delusions, for some hours before an attack." (*Loc. cit.*, p. 736). (With M., we had a decided prodromal change of extended duration. She had not slept the night before the crisis, and she had no breakfast, feeling dull, confused, "not herself.")

Changes of Phenomena in Different Attacks.—The same mental state of an attack often repeats itself with successive attacks, and the same actions are also liable to repetition (in M. two similar suicidal attempts); but sometimes attacks and mental states, with actions, much dissimilar from each other occur. As to the mental disorder, one of the *conclusions of La Société de Médecine Légale*, in 1875 (Féré, *Les Épilepsies*, p. 601) was that:

"La perversion mentale en particulier peut varier non seulement chez les divers sujets, mais chez le même malade en dehors des plus habiles prévisions." "L'état mental de l'épileptique se modifie selon l'âge et les événements de la maladie."

To which Féré himself adds (*loc. cit.*, p. 604):

"S'il est vrai que chez le même malade les accès présentent en général une grande analogie, quelquefois même une véritable similitude, cette similitude et cette analogie ne sont pas fatales; un malade qui a ordinairement des troubles psychiques avec accompagnements somatiques à propos de son attaque peut avoir pas dans telle circonstance;

inversement, tel autre malade qui n'en a jamais, peut en présenter accidentellement sous une influence difficile à déterminer, un léger excès alcoolique ou autre, une émotion morale, etc."

This possible changing of the nature of an attack might explain the isolated occurrence of objective dangerousness of M. In fact we know that many epileptics do not become dangerous to life, except on special, sometimes very rare occasions—occasions which, unfortunately, we but seldom fully understand and of which we usually know nothing in advance. There are very few cases on record where an epileptic has done in his life more than one murderous action, and consequently we have to assume that this action and that special form of mental derangement which leads to it, are with all epileptics only more or less exceptions.

Dangerousness of Petit Mal.—Whatever the nature of a minor epileptic attack is, it is certainly one of the most, if not the most dangerous forms of epilepsy to others. Not only murders happen during this minor form of epilepsy, but also violent assaults of all kinds, suicides, incendiarism, exhibitionism, etc., and these ugly acts are met with in large numbers of epileptics (five per thousand) in every class of society so frequently, that it becomes of great interest to enquire about the real nature of the impulses which lead to these harmful actions.

Moreover, the real state of mind during these attacks and during the actions in the same, is a great problem of forensic medicine, and especially to that part of the medical profession which is frequently called upon to help decide if a subject is or is not responsible for a certain crime.

The matter is further complicated frequently by there being an apparent object to the crime, or a cause for it; and again, the criminal act committed by an epileptic during a minor attack of the disease, does not by any means always bear the signs of an unconscious or a blind deed, but instead of that the act would often, seemingly, indicate deliberation and reason.

Psychology of Epileptic Crime.—Are there any such conditions of mind in which an apparently actuated or a deliberate, simple or complicated act could be committed, without the presence of consciousness and a wilful direction?

(The actions done in such mental states are commonly termed automatic actions).

Clouston, for instance, says (Ment. Dis., '96, p. 14): "In many mental diseases the brain acts automatically, even suicidal, and homicidal impulses taking place when volition and consciousness are absent." And Maudsley (Path. of Mind, p. 483, et seq.), speaking particularly of epilepsy, declares that: "A person may plan and perform, while in the inscient epileptic state, what he does not remember when he comes to himself and what his sound self would never dream of doing." "Although the epileptic may know what he does when he does homicide, it is still not himself but a transformed self who knows and does it, a being incapable of the same feelings and thoughts of his natural self capable only of the insane feelings and thoughts of morbid self."

Diagnosis of Epileptic Mental State.—How are we to judge whether such a semi-conscious mental state has or has not existed in a given instance of crime and particularly murder? We know of no direct test by which to decide this question. We do not know how to prove the existence of such a subconscious mental state, and still less can we determine the fact of its previous existence unless it be by induction. The only indications that we have as to this semi-conscious mental state are the symptoms observed before and after the transgression, the subjective impressions during a portion of the attack given by the patient himself and the character of the acts done in the epileptic state.

The subject can usually tell us but few things; he will tell us of his last conscious sensations before the semi-conscious mental state has come on, and the first conscious sensation after it has passed; occasionally there

is a confused recollection of what happened in the meantime or of only a certain particular event. If we have an epileptic to deal with, he will describe his last thoughts before the spell and possibly an aura, after this mental blank or a confused recollection of something follows, and then there is like an awakening, with new, strange circumstances, and a general bad feeling with mental dulness. If the subject is then asked about what has happened to him, he professes ignorance, and he does not even dare to mention his confused recollections, if he has any, for fear of their misinterpretation and from uncertainty of their reality.

If he has committed a crime in the abnormal state, and is asked about it and about his motive for the act, in Maudsley's words, (Pathol. of Mind, p. 486) he "can give no sensible explanation, because of his partial and confused recollection, he perhaps tells such a lame and inconsistent story that he is suspected of feigning to forget and of playing the imbecile, or he can say *no more than that a cloud came over him, or that something rose in his head, like a mist*, whereupon he lost his senses and knew not what he did." The subject rarely *denies* that he has done something of a criminal nature.

Delasiauve is very correct in saying that "They acknowledge their crime without reticence because in it they see only the result of a legitimate defense or an involuntary action and they feel sorrow rather than remorse. Indifferent to the dangers which menace their existence or liberty they make no effort to efface the traces of their transgression or to escape from their pursuers."—(Lombroso, L'Homme Crim., p. 594).

Memory of Acts Done in an Epileptic Attack.—In rare instances, when asked very soon after the crime what they have done, they will describe their action and give even some plausible cause for it, only to forget soon after everything that was done and what was said. In other few instances, within some time after the attack, recollections of what was done seem to be present, but

these instances of recollection are brief and the subject relapses again into his forgetfulness. In still other instances a recollection which at first was extremely hazy, will be gradually formed as if built up by the subject, so that he may at last have a fair understanding of his action; but in these latter cases much seems to be based on after information and circumstances. In fact, after an epileptic attack with some action in the same, all degrees, except the complete, and all kinds except the really clear stages of recollection are possible.—(Sammt; Gray, etc.)

Characters of Epileptic Murder.—The character of the criminal act itself usually helps us very much in arriving at a diagnosis of the state in which the act was committed. If the crime committed is a murder, generally the act is very abrupt, very brutal and without any usual motive. There has been no warning of the deed; the wounds made are more numerous or greater than necessary for killing; and it is said that most often innocent persons have been slain (which would probably not be borne out by facts if we should accept as guilt the rendered irritation).

Trousseau, and with him, Krafft-Ebing (*Gerichte, Psychopathologie*, p. 224) declares that “we can assume, almost without a danger of being deceived, that when an individual suddenly commits a murder, without a preceding alienation of mind, without having presented up to the time any signs of insanity, and without a passion—motive, or without having the nervous system deranged through alcoholic or other intoxication, that that person has committed the murder in an epileptic attack, either in grand mal or, what is more frequent, in a minor attack of the disease.”

But no one of the characters of epileptic murder is absolutely specific or constant, and there may be exceptions to any one or to all of these characters. This fact is well recognized by Magnan (*Lec. Clin.*, p. 602,) who says “Definite characters are generally attributed to the acts of the epileptic; but such acts are not determined by any single motive or always any apparent motive; the acts show

no selfish motive and their violence is incommensurate with the purpose to be accomplished. None of these characteristics is specific."

The signs in some of the reported cases of epileptic murders differ in no way from the signs of a murder done by any ordinary criminal. Still, when any of the above mentioned unusual signs attend a murder, they ought to suffice to arouse suspicions of epilepsy and warrant a thorough medical investigation.

Subject after an Attack of Epilepsy.—When the attack is over, or, at least, when the active part of an epileptic attack is over, "the patient may be at once quite well. Often he is stupid and dull for a little time, and sometimes proceeds to perform some action in a dream-like, automatic manner." (Gowers: Diseases of Nervous System, Vol. II, '95, p. 736).

According to the same author hysteroid phenomena occur frequently after the minor attacks, and occasionally after the major. Sleep, which so often terminates an attack with pronounced convulsions, is rare after attacks of petit mal. The most frequent phenomena after a minor epileptic attack, are some form of general or local indisposition in the body, and mental stupor, or dulness or confusion.

M.'s Case.—Of all these characters of a minor epileptic attack and of the deeds done in the same, how many and which signs do we find in the case of M. which may be similar and point to such a morbid seizure more than to an ordinary affair of murder?

There was an aura, or at least aura like symptoms, following immediately the emotion aroused by C.'s taunts. There was a great, sudden heat in the head and a flash before the eyes and then a darkness; further on M. denies every recollection. The deed was extremely abrupt, without the slightest warning to anyone, and it was brutal, particularly so, the slayer being a woman. Immediately before the deed a witness saw M.'s face turn deathly pale and her eyes roll. A second or two after the infliction of the wound there was a fall to the ground. A spontaneous

rise soon after; no attempt to escape; pale features; some gesticulation on the sidewalk and some words. Then M. says she noticed blood on her hands and, thinking she had injured her hands in some way, she examined them, and then washed them on the street in a pail of water from a grocery store. She was seen to act according to this description.

M. is taken into the grocery store, whither she goes passively; people surround her, but she is confused; no one can remember that she answered a single question; she displays no nervousness. From the grocery store M. leads a policeman into her room, precedes him, on his demand, quietly, without a word. In the room she still appears confused to those who came with her. She takes off a blood-stained waist and throws it out of the window on the street, and the woman, who is usually so bashful, stands in the room before strangers, including men, with nothing on her chest but an undergarment, without showing any disposition to cover herself; her mother brings a garment and dresses her. Maria does not utter a single word. The policeman has no trouble with the culprit, she walks with him quiet, speechless, and with the same demeanor walks from the first police station to the second. At the second station-house, and still later on, M. seems still confused and a "person without reason" to some observers, but in the meantime she makes some effort at explanation of her act to those who question her; she gives a fairly consistent story of the act without a shade of self-denial, and lapses into her hebetude immediately afterwards, never to remember afterwards the particulars of the act, nor those of her arrest, nor those of any conversation, and she never tells anything any more to anyone about the murder. The first few nights and days in the prison M. spends in doubts of the truth of the story they tell her, and in crying for Cataldo. M. "never cares what they do with her, she only loves Cataldo and is sorry for him, and is sorry for her own family, especially for her mother." As to herself, M. "never has reproached her-

self of having done anything wrong to Cataldo, she does not know about it, and has no pangs of conscience."

CONCLUSION.—Are all these facts, with all the other facts we know, sufficient for us to diagnose M.'s act as an act of an epileptic, as a murder done in a minor form of an epileptic attack, and the impulse a morbid impulse of an epileptic condition—in other words, to sustain the medico-legal opinion outlined in the beginning of this section?

I do not think the answer to the above questions, although they are questions of a capital import, will be difficult for anyone. For myself, I only wish to say this: *It is an injustice to society and to the subject himself, when no laws exist which would, after a being is lawfully exonerated from so serious an offense as a murder, provide permanently for his own safety and for that of others.* It is a sad deficiency in our laws which allows an unconditional liberation of the criminal-epileptic.

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MELANCHOLIA AND ITS TREATMENT.

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Owing to its frequency, melancholia is one of the most important as well as interesting forms of mental disorder that hospital physicians are called upon to consider. While the general symptoms of melancholia begin in about the same manner, they are likely to develop and branch out, in the early part of the disease, in directions not easy to foretell, although the ultimate result of the disease may be prognosed in many instances with considerable certainty.

The fact that the causes may be the same in producing several given cases of melancholia is, however, no guarantee that the course and termination will be identical. Whether the disease is going to be acute, chronic or resistive will depend upon the nervous predisposition of the patient, and this makes the course of the disease uncertain.

By the term melancholia we recognize a form of insanity characterized by profound depression of spirits, with a tendency to suicide and perversion of views on subjects regarding self, accompanied by a real or imaginary physical enfeeblement. It begins slowly and insidiously, and the change in the general character of the patient may not be recognized or appreciated by his nearest relatives.

The first symptom noticed by the patient or his friends may be some dyspeptic trouble, or some irregularity of a function previously regular in the performance of its duty.

There may be a little more irritability of disposition, amounting to a certain unreasonableness, coupled with a restlessness in manner that is not usual, and a complaint that the nights have been wanting in restful sleep; that disturbing thoughts have been too persistent. He begins to lose weight, shows a lack of energy, which is apparent not only in his actions but in speech, and at last even his tone of voice suggests an indifference that amounts to absolute apathy.

As a rule, a case of melancholia develops very slowly, the friends believing that the patient has nothing more than an attack of the blues, or that he is not exerting himself as much as he should, and perhaps advocate a change of scene and a more frequent indulgence in social pleasures, but as the disease increases, the patient shows an inability to appreciate enjoyments that were once entered into with zest, and he finds that there is a complete change in his feelings; that the things he once liked have become as nothing, and the objects of sympathy and love have become to him objects of indifference, or even of loathing. He feels that his own self-respect is a thing of the past; that he amounts to nothing; that his life has been a mockery; that no deed of his has ever been begun and carried out with an earnest desire to benefit others, but has had for its mainspring the most despicable of selfish motives. As one patient wrote: "I am dying; I shall never see the dawn of another springtime. My weight is ninety-eight pounds. My blood is charged with poison. The twilight shadows of eternal night, without a star of hope, are thick around me, and afar off is my earthly experience; an awful glimpse of the bottomless pit was given to me the other night, as full of devils as the heavens with stars, and every one a writhing serpent in form. Over this pit I am hanging, supported only by this rotting body." This is quoted from a letter of one going into an attack of resistive melancholia that lasted two years and terminated in complete recovery, the main symptoms of which are described further on.

The physical symptoms of melancholia are cerebral congestion, generally an erythematous condition of the neck; patient complains of head feeling empty, dull, as if it were dead; has lost all sensation; that it has filled with water; headache generally frontal; when located in back of head and neck, and accompanied by throbbing along the spine, there is usually a history of sexual excess, or an emotional strain has been the exciting cause of the disease: appetite variable—it may be good, fair, or food may be refused altogether; digestion impaired in all cases, and in such post mortems as we have been able to hold, the whole intestinal canal has been found dryer than usual.

In cases of long standing in which there has been much wasting, this condition of dryness exists in all organs. Flatulence is common, generally there is a slow action of the heart easily accelerated by excitement, cold hands or feet, restlessness, tremulousness, insomnia, starting at the slightest sound.

The patient feels as if electric shocks were going through him; there is a twitching of muscles or groups of muscles, which symptom is aggravated by the patient thinking of his condition; coated tongue, foul breath, pupils changeable, and lax condition of the muscular system and skin. The skin is dry and harsh, frequently exfoliating for months at a time, unless extraordinary precautions are taken by the nurse in the bathing and oiling of the body of the patient.

In several instances in which the mental strain has been for some time intense, convulsive attacks may occur, in which the patient will throw himself in a manner that would be impossible for him when in the best of physical training; turning somersaults on, off and under the bed, about the floor or grounds or wherever he may be; jumping about, and snapping the jaws together like a dog. Such are the usual forms of this peculiar manifestation. They come on suddenly, without any warning whatsoever, and are followed by a pronounced fatigue, with a confused recollection of what has taken place.

In all cases in which these conditions have arisen, the disease has been of long standing, the patient much given to worry, and the outcome at times seemed uncertain, yet they all eventually recovered and retained their health. Another singular feature is that although these attacks appear dangerous to the physical welfare of the patient, yet to my knowledge no injury has ever resulted from these paroxysms.

Mental Symptoms.—Depression of spirits; perversion of emotions, sympathy and love for relatives and friends gone (these can not be awakened by any ordinary means); indifference to association; attempts at suicide; morbid fears of places and people; inattention and forgetfulness; inability and incapacity for continued work; the patient watches his symptoms closely and exaggerates their importance, believing that no case in the world was ever just like his. He believes that he has committed the unpardonable sin; that his presence in the world is a menace to others; he refuses food on various grounds; that his people are too poor to pay for it; that it is wrong to eat; that God tells him he must not eat; that the food belongs to another; and any efforts to get him to take sufficient nourishment are met with his best efforts to reject it, under the influence of his beliefs. He quickly adopts ideas from others that he thinks apply to his own case; and with all the strength of his disease-perverted will-power refuses to accept any other view of his situation than that which he believes to be the true one.

In melancholia we frequently find that the perversion of a single sentiment completely changes the current of a life. In one gentleman, an outraged pride resulting from the commission of a deliberate act, that all relatives and friends believed to be a consistent one, was sufficient for the relinquishment of large business interests, with all of his social relations, that for years had been peculiarly congenial, and with a fixed purpose that he would never see any of his relatives again, and would hold no com-

munication with them; that he was dead to them in every sense of the term. Keenly alive as ever on every question of the day, watching with lively interest the attitude of his business and political friends, a stranger could only wonder why such a man required hospital care; yet he maintained this uncompromising attitude for nearly ten years, until death came to his relief.

The egotism manifested by this class of patients is unapproachable. Sameness of thought and expression is the rule. The patient believes that he is dead; has no desire to exercise. He believes that nothing passes his bowels, and it is useless to attempt convincing him of his error. The logic of facts, as supported by the senses, fails. Frequently he will state that his memory is good; that his judgment is unimpaired, and that everything is all right, with the exception of his own future hopelessness. There is considerable truth in the fact that his judgment may be good, also the memory; for several instances have come under our observation in which confirmed cases of melancholia, with strong suicidal tendencies, unable to be left alone with safety at any time during the twenty-four hours, have not only settled up estates, but have given advice to their friends regarding the purchase and sale of stocks; watching the fluctuation of the Wall Street market reports with as much acuteness as if they did not believe that they had committed the unpardonable sin, and the future held nothing in store for them but disgrace and oblivion.

As Dr. Guislain says: "I meet every day with melancholiacs who do not exhibit any disorders in their ideas or lesion of the judgment. Melancholia is exclusively an exaggeration of the affective sentiment; it is, in all the force of its significance, a *Gemüthskrankheit*, in the sense in which the word is employed by German psychologists. It is a pathological emotion, a sadness, a chagrin, a fear or dread, and nothing more. It is not a condition which sensibly weakens the conceptive faculties."

Every day we see in our associations with our fellowmen

those who are strongly predisposed to nervous disease by an unfortunate inheritance, by irregularity in living, or, perchance, by some accident,—a tendency that, if the circumstances favor, will surely develop into an attack of melancholia.

A good many people possess a nervous organization that makes them a prey to every unfortunate circumstance in life to which they may be subjected. A hasty reply from one they love and respect, a rude touch, are things that to them are matters of serious import, and change the life of a day, a month, or a year, as the case may be. They lack an element of elasticity, a certain coarseness of mental fibre, and it would be far better for them, if they wish to enjoy life thoroughly, if an indifference might take the place of their too morbidly appreciative sensitiveness. They are inclined to be consistent in their aims and intentions, and possess a high degree of conscientiousness, so that a necessity for a sudden change in aspirations or duties carries with it a shock that, to a more obtuse or stronger intellect, would be as nothing.

For many years it has been noticed that those who are afflicted with irritable hearts are not able to control themselves so entirely as those with healthy hearts. Their emotional natures are seldom long in repose, and consequently they are never able to store up any amount of reserved energy for a time of need. Wherever such a heart exists it registers the disturbance of every organ in the body. Physical and mental efforts; sexual excesses; toxical influences arising from habits; climatic conditions and auto-infection all unite in their effects to stimulate unevenly and to exhaust the heart itself, but before this is accomplished there is created a feeble condition of some part of the nervous system that eventuates in melancholia.

When children show these peculiarities, our duty, when professionally attending the family, is to caution against any emotional excess or strain on their part, no matter in what way that danger may arise, whether in habits or in studies. Such temperaments must be taught the absolute

necessity for obtaining and keeping a certain amount of reserved energy, otherwise they will never be able to gain strength, to work for others or for themselves, or to enjoy life in a reasonable manner; but they are liable to break down with melancholia, or some other form of mental disease.

Some years ago Dr. T. Duncan Greenlees examined some 672 patients, of which 122 were cases of melancholia, and 39 of general paresis. He found that something like 50 per cent of these cases were afflicted with derangement of the heart, and that over 43 per cent of the cases of general paresis were similarly afflicted.

In an examination of one hundred patients suffering from melancholia reported by Dr. S. H. Talcott in the January number of the BULLETIN, the heart was found to be affected in the following proportions:

	MEN	WOMEN.
Normal.....	16 per cent.	6 per cent.
Hypertrophy	8 "	6 "
Irritable.....	36 "	52 "
Weak.....	28 "	28 "
Valvular	12 "	2 "
Resistive and could not examine.....	————	6 "

From these facts, I believe that due attention to the condition of the heart in the early stages of melancholia may frequently be the means of averting an attack.

Acute and chronic melancholia differ more in degree and duration than they do in their symptoms. Just where the boundary line is between the acute and chronic form, it is hard to determine. We are in the habit of referring to a case that has been running for two years or less as an acute case, after that time to class it as chronic. This is purely arbitrary, and does not signify that the patient is incurable, for many cases under our observation have regained their health after years of abject depression and helplessness.

The resistive is the most trying form in which melancholia presents itself to friends or physicians. The persistency, force, ingenuity and general innate cussedness

that characterize these patients in their efforts to study out and execute the most effectual method of causing trouble to their nurses and of baffling their physicians, never cease to be an object of wonder. Suicidal impulses may show themselves equally strong, but as a rule they are paroxysmal in their nature. The extent to which these patients show this resistive power hardly permits an intelligent description. Resisting every effort to improve their condition or surroundings, they refuse to eat, and will expectorate food when placed in their mouths, depositing their expectorations on the faces of nurses, on their clothing or their beds. They resist having a bath, resist leaving their beds to enter the bath-room, try to prevent their clothing from being removed, and every effort to put clean clothing on them is viciously resisted. They object to returning to bed, to lying down and permitting themselves to be covered, or to have enemas given them. Frequently they will scream with their utmost strength, using one word or phrase over and over, until they become too exhausted to do more than whisper, which they will continue to do. They become thin in flesh, frequently going months or years without taking food voluntarily, or speaking; constantly resisting, yet appreciating what is going on about them, and on recovery recollecting much that has transpired during the sickness.

As to the causes that lead to melancholia, profoundly depressing influences, either physical or mental, on a predisposition, will lay the foundation for the difficulty. Resuming work and taking up a mental or nervous strain too soon after recovery from a physical disease, is frequently found in the history of cases of melancholia. Heredity is a prominent factor; imperfect mental growth, wrong methods of training, and mistaken efforts in education. An emotional overstrain co-exists with every case of mental depression, consequently we find that death of friends or worry in any form is sufficient to plunge many into the depths of despair.

Worry I find to be one of the probable causes of melan-

cholia. The class of individuals who are given to worry is particularly men of mediocre mental ability who are more easily irritated, more easily made suspicious and exacting, than are those possessing a greater mental grasp and equi-poise. The former relapse into worry as the natural result of a nervous strain. The latter throw it off by pursuing a new train of thought. How much this may add to the condition of the individual, it is difficult to estimate, but we find in melancholia, as well as in general paresis, that worry is a more frequent exciting cause than all other causes combined.

There is no one physical disease that has in recent years done so much to predispose many individuals to attacks of melancholia as the grip. The enervating effects upon the nervous system have been wide reaching, and for years to come, we shall have cases of insanity admitted to our State hospitals in which the mental symptoms may be directly and truly traced to the prostrating effects following an attack of the grip.

We herewith present some remote and predisposing causes of melancholia, together with the percentages in which these causes have occurred in the cases tabulated; also the percentages of age of the patients admitted under treatment.

PREDISPOSING CAUSES.

Predisposition.....	53.1	per ct.
Heredity.....	14.5	"
Overwork.....	5.5	"
Physical disease.....	6.7	"
Pregnancy.....	.2	"
Worry.....	2.2	"
Masturbation.....	.7	"
Insomnia.....	.1	"
Senility.....	2.2	"
Injury.....	.8	"
Venery.....	.3	"
Insolation.....	.3	"
Climacteric.....	.5	"
Alcohol.....	.7	"
Religion.....	.1	"
Fright.....	.1	"
Not ascertained.....	12	"

EXCITING CAUSES.

Worry.....	40.5 per ct.
Masturbation	8 "
Overwork	6.8 "
Physical disease.....	12 "
Alcohol.....	5.5 "
Climacteric.....	4.3 "
Drugs... ..	2.7 "
Pregnancy	2.7 "
Fright	1.6 "
Religion.....	1.3 "
Injury.....	1.8 "
Venery....	1 "
Insolation.....	1.2 "
Senility.....	.9 "
Epilepsy.....	.9 "
Heredity.....	1 "
Operations .....	.2 "
Predisposition.....	1.7 "
Lactation.....	5.6 "

Under 20 yrs.	20-25	25-30	30-40	40-50	50-60	60-70	over 70	Not given.
3.2%	12.4%	12.4%	26.9%	22.6%	14.7%	7.7%	2%	.5%

In the treatment of melancholia, the first attempt of the physician should be directed toward an improvement in the condition of whatever perverted vital function the patient may have developed, consequently there is a wide field to consider when we attempt to aid a patient to regain his health. Each case of melancholia must be individualized closely. Such patients are weak neurotically in some direction, and very few are alike.

Everything that relates to the maintenance of healthful functions, and every influence that promotes the activity of those that are sluggish, become at once points of interest in establishing a course of treatment. Preventive medicine is of as much importance as active drugging. The patient's physical strength must be saved, and he must not be allowed to exhaust himself needlessly, either physically or mentally.

In melancholia we recognize an exhaustion of nervous strength which calls for rest and nutrition. That this may

be accomplished, the elimination of all waste products is brought about by drinking freely of pure water, and by irrigating the bowels every third day with water that has been boiled, used as hot as possible, and retained until it has been absorbed and passed through the kidneys. The quantity to begin with should be about one pint, and may be increased to three pints without difficulty. This should always be used hot to escape the unpleasant symptoms liable to follow the use of cold water. It has been claimed that the frequent use of this method produces a weakness of the intestinal canal, rendering its condition worse than the difficulty the treatment was supposed to remedy, but, after employing it for a number of years, nothing but praise can be given to it.

In cases where the emaciation has been rapid, oil, about two ounces with each enema, should be given and retained by the patient. The more of this oil that is absorbed, the more quickly a healthy action of the intestines will return. Where this flushing has been continued from one to three months, as seemed necessary, a marked change for the better has occurred in every patient on whom the treatment has been employed. It eliminates the effete material retained in the intestinal tract, induces a freedom from auto-infection, and consequently allows a more thorough oxygenation of the blood, and permits better results from the action of medicine.

Any condition of constipation in a case of melancholia is an evidence of lack of care of the physician and nurse in charge of the patient. Intestinal antisepsis is of as much value in the treatment of melancholia as it is in the treatment of typhoid fever or of cholera. Irrigation of the bladder should be employed whenever the urine becomes thick with sediment, and may also be used in case of enlarged prostate.

In a case of dyspepsia, when the patient's refusal of food can not be overcome, it is well to irrigate the stomach, washing it out carefully. We have frequently found the large quantity of offensive catarrhal secretion sufficient

reason for his refusal to eat, the patient eating a few hours after the stomach was irrigated.

The rest treatment for melancholia in all its forms has been tried during the past eighteen years sufficiently to demonstrate its practical value. The existing strength of the patient is preserved and augmented by this treatment. The patient being under the direct observation of a trained hospital nurse, the bodily functions are closely watched, and every means taken during this period to establish a functional regularity. Under this method constipation is a rare occurrence. The heart becomes stronger by rest and by the method of treatment previously described.

Feeding a patient through the nose by employing Paine's nasal feeding tube, has been found to be the easiest, most humane, and in every way satisfactory method when the patient refuses to eat.

After rest and treatment, exercise becomes important. Many patients take too much exercise, and some not enough, while others take enough in amount but not of the right kind. Muscular energy, with its consequent nervous exhaustion, from which the patient rallies slowly, can not be considered remedial. We can not, therefore, prevent an outbreak of melancholia by prescribing travel that will entail excitement or irregular hours, but a change of scene and associations that tend to rest and enliven the mind of a patient and take his thoughts from himself, may prevent an attack.

Exercise should be taken so soon as the physical strength will warrant, and in moderate amount without a weariness from which the patient does not quickly rally. The character of the exercise taken is of much importance. A sedate walk without purpose, the patient returning to the house with enfeebled circulation, cold hands and increased depression of spirits, does not represent any advanced line of treatment. A short time in the house devoted to exercising the muscles of the back, chest and arms, systematically and regularly, to inhaling the fresh air and expanding the lung tissue, thus strengthening the heart

with good blood, is of greater benefit than the usual walk. Wherever this can be combined with outdoor exercise, it is important to do so.

In the matter of food for those suffering from melancholia, I believe that the widest choice should be made. Our knowledge of dietetics has not reached that degree of perfection in which we can determine with accuracy the result of any certain form of diet in individual cases, and some article of food that is craved by the patient may prove most easily digested and most nourishing, that to the medical attendant may seem absolutely unfit. The whim of the patient should be thoughtfully considered. Capriciousness of appetite exists among the insane as well as the sane. After nearly three weeks' abstinence from food, having had nothing but a quart of champagne daily, a patient called for fried ham and eggs. This was given him, and no discomfort arose, although his refusal of food had arisen from distress caused by chronic gastritis. The refusal of a patient to take food may arise from an inability to take it—unaccompanied by delusions—solely from an instinctive repulsion caused by an inability to digest food when taken into the stomach. Sterilized milk given hot will do more in most instances than any form of liquid diet. When difficulty is experienced in digesting it, the use of salt or lime-water will generally remedy it. Beef tea has been found of little use; chicken or mutton broth is preferable, and is appreciated by the patient. Scraped beef, raw or slightly toasted in the form of cakes, makes an important form of diet. A meat diet, with plenty of ripe fruit, is found to be well adapted to those patients who have an acid dyspepsia. Roast beef and steak are most important aids in restoring the strength of a patient.

When the patient must be fed by a tube, bovine (one teaspoonful), Mellin's food (two teaspoonfuls), and hot milk (one-half pint), have been found very satisfactory, patients living on this for two or three years at a time without difficulty, and in a number of instances recovering.

Plenty of fresh eggs and milk may also be used, some

patients readily digesting from six to twelve eggs a day without discomfort, and with marked benefit. Everything that is given a patient with depressed vitality should be given as hot as possible, and in as appetizing a manner as can be devised. The gratification of the senses should be called into service to aid the physician's efforts as much as possible.

In the treatment of melancholia, there is no remedy in our materia medica that may not be used.

The physical condition of the patient usually demands the first care and when there has been considerable wasting, caused by mal-nutrition and imperfect assimilation of food, from dyspepsia or irregular habits of living, remedies are given to meet these conditions.

In some cases antiseptic measures are required, as many cases of melancholia have auto-intoxication as a prominent feature.

Tonic remedies are generally the first to be considered in the treatment, especially when the patients have become somewhat advanced in their course.

Aconite.—Aconite is useful for the relief of transitory conditions, such as timidity, fear that something is going to happen or of approaching death, irritability about trifles, and excessive restlessness, accompanied by a hot, dry skin, congested face, and a strong, full pulse.

Arnica.—This remedy acts especially upon the muscular, serous, and cellular tissues and tendons, and is required when the conditions are similar to those resulting from injuries, falls, etc., both external and internal. A bruised sore feeling is its leading indication for use.

Mentally, the mind is dull to unconsciousness, can be aroused, but soon relapses into indifference to everything; memory poor.

Arsenic.—The preparations of arsenic have an action upon almost every organ and tissue in the body. Acting, as it does, upon the blood and the nervous system, its use has been very satisfactory in the treatment of melancholia.

The mental symptoms of this drug are nervous restless-

ness, with much thirst, which is relieved by small quantities of water at a time; a strong tendency to commit suicide to escape suffering; faultfinding, capriciousness, and easily excited anger, also great fear and anguish. The head symptoms are those of anæmia, with an amelioration of symptoms when out of doors.

Baryta Carbonica.—This remedy is especially useful in cases suffering from a depressed condition of the cerebral and ganglionic nervous system, accompanied by a loss of energy, both mental and physical, as found in cases of premature exhaustion, and early decay, with glandular difficulties. Here we find the patient irresolute, forgetful, weak in mind, poor in memory, and lacking self-confidence. The skin is unhealthy with a tendency to dermatitis.

Belladonna.—In belladonna, congestive states are prominent, a tendency to delirium with illusions, hallucinations and maniacal outbreaks, and insomnia, with a general hyperæsthesia of both sensory and motor nerves. The condition of the skin in the belladonna patient is particularly indicative, it being red and hot like the smooth, shining, red surface that is found in scarlet fever, and non-vesicular erysipelas. The pulse of the belladonna patient is hard, full, and bounding, and the pupils are dilated. Also, there are a sudden appearance and disappearance of the symptoms.

The mental symptoms of belladonna are: a vicious rage, anger, disposition to bite or strike, to spit at those about him, or to tear things to pieces, a violent delirium, laughing, grinding the teeth, changing easily from mirth to fury, constant desire to spring out of bed, a complete loss of consciousness, hallucinations of sight, either a disinclination to talk or rapid talking, and violent throbbing of the arteries, aggravated by noise or motion.

Byronia Alba.—This remedy acts upon the serous membranes, the pleura, lungs, brain and liver. The characteristic symptoms calling for the use of byronia are stitching, tearing pains, and the aggravation of all symptoms by motion.

The mental symptoms are those of ill-humor, needless anxiety, irritability, depression and apathy. The thirst of the byronia patient is for excessive quantities of water.

Cactus Grandiflorus.—This remedy acts upon the circular fibres of the heart and arteries. The peculiar characteristic calling for its use, is a constrictive sensation about the heart, as if grasped by an iron hand.

The mental symptoms are sadness, hypochondriasis, a tendency to weep, and marked paleness of the face.

Calcareo Carbonicum.—Owing to the peculiar action of this drug, it is one of the most important in the materia medica, and is frequently overlooked. It acts primarily upon the vegetative system, exciting moderately the functions of secretion and absorption. Patients with light hair and blue eyes, who are capable of little physical endurance, although possessed of large muscles, and who are naturally inclined to be indolent; or those who are imperfectly nourished, and who seem to have come into the world half-made up, appearing to live in constant fear of scrofula, tuberculosis or rachitis, will find calcarea carbonicum an important remedy.

The mental symptoms of this drug are those of great anxiety. There is palpitation of the heart, depression, disinclination for work, apprehension of impending evil, fear of losing the reason and that people observe their condition, shuddering without cause and an increase of apprehension toward evening.

Carbo Vegetabilis.—This remedy is important on account of its action upon the mucous membranes, especially the digestive tract, and is frequently of use in cases of dyspepsia, where there is an excessive accumulation of gas in the stomach and bowels.

The mental symptoms are those of indifference to everything, and a sluggishness of thought, accompanied by anxiety and oppression.

Chamomilla.—Chamomilla becomes useful when there are general exhaustion and prostration accompanied by

excessive sensitiveness to pain, and by peevishness and irritability suggestive of the age of childhood.

Mentally, the patient is anxious, uneasy, fretting, moaning about trifles, with a peevish, whining restlessness, satisfied with nothing, and possessing the belief that the pains are intolerable, and can not be endured.

Cicuta.—The action of this drug is believed to resemble very closely that of *nux vomica*, with the important difference that in the latter the consciousness is unimpaired, while in the former the functions of the brain are relaxed, and an entire loss of consciousness is the result.

The mental symptoms are those of depression, aberration of mind, singing, performance of the most grotesque steps, shouting, contentment and a happy, dull, stupid apathy.

Cimicifuga.—This remedy affects the brain, the spinal cord and the entire nervous system. It is especially useful in conditions of rheumatic and neuralgic disturbance, and in diseases of the female generative organs. *Cimicifuga* is supposed to increase the contractility of the unstriped muscular fibre, but to a less degree than ergot. The heart-beats are slower, and the arterial tension increased. In the brain the primary action is to cause congestion, giving rise to vertigo, dilated pupils, and other symptoms similar to those of belladonna, though less intense. The leading indication for the use of *cimicifuga* is an apprehensive, nervous, irritable state of mind.

Conium.—*Conium* acts upon the motor-nervous tract, especially the peripheral extremities of the nerves. *Conium* is adapted to diseases of old people, particularly old men.

The mental symptoms are ill-humor and moroseness, hypochondrical depression and indifference, inability to sustain any mental effort, want of memory, difficult comprehension, and desire to be let alone.

Digitalis.—*Digitalis*, acting, as it does, on the muscular substance of the heart and arteries through the pneumogastric and vaso-motor nerves, is found especially useful in sudden attacks of cardiac failure and functional derange-

ment of the heart, with slow, intermittent pulse. The heart symptoms are the most prominent in digitalis, although there are great anxiety, apprehensiveness, slow thought, and weakness of memory.

Ferrum.—Ferrum acts pre-eminently upon the blood, and has had, for years, an established reputation in the treatment of all forms of anæmia. Hughes has remarked that the “malady does not ordinarily arise from any failure in the quantity of iron supplied in the blood. If the element is deficient in the blood, the fault lies in the assimilative processes. But Reveil has ascertained that in anæmia there is no change whatever in the amount of iron present in the blood. However few the corpuscles, they contain within them the full proportion of the metal normal to mental health; and though under the influence of iron itself they increase to double and triple their number, they yield no more iron.” If this be true, ferrum does not act as a curative agent by virtue of absorption as a constituent of the blood, but rather by its physiological effects upon the organs and tissues of the body.

Graphites.—This remedy acts especially upon the skin, the lymphatics, the digestive system, and the sexual organs.

The mental symptoms are those of despondency,—thinks of nothing but death, apprehensive, hesitates about everything, is absent-minded and forgetful; head has sensation as if it were numb and pithy.

Hypericum Perforatum.—This remedy acts through the cerebro-spinal nervous system, and is found useful in mechanical injuries of the spinal cord, and of the nerves at their peripheral extremities, especially when accompanied by excruciating pains. It has been well termed the “arnica of the nerves.”

The mental symptoms are those of weakness of memory, great nervous prostration following injury, confusion, vertigo, and heaviness of the head, with tearing stitches in the brain and throbbing in the vertex.

Ignatia.—Ignatia is one of the most valuable remedies in cases of melancholia. It acts upon the medulla oblongata

and the spinal nervous system. The leading expression of ignatia is found in an acutely sensitive mood, with tendency to sadness and silent grief, and a continual brooding over imaginary troubles.

The mental symptoms are depression, apprehensiveness, anxiety, and a changeable disposition; frequently having the belief that some great crime had been committed by him; inconsistent, irresolute, and taciturn. The characteristic headache of ignatia is as if a nail were driven through the side of the head, and is relieved when lying on the painful side.

Iodine.—This remedy acts especially upon the ganglionic nervous system, and through it upon the glandular and mucous tissues. The glandular action of iodine is especially centered upon the thyroid, the mesenteric, the mammae, ovaries, and testicles. Of the mucous membranes, its action is most noticeable on the respiratory tract. The indication for the use of iodine is shown in rapid emaciation.

The mental symptoms are those of depression, and an excessive nervous excitability, with throbbing headache, and throbbing of the entire body, tremor of the heart, worse after immediately rising from seat or bed, worse on motion, and worse in the hot air.

Iodide of Potash.—The action of this drug upon the lymphatic glandular system is very similar to that of iodine, producing hypertrophy, and loss of function. It produces thickening of the periosteum, and for this reason is often beneficial in syphilitic nodes.

The mental symptoms are depression and anxiety. The pain is generally in the upper part of the head, with a feeling as if it would be forced apart.

Lillium Tigrinum.—This remedy acts profoundly upon the female generative organs, and upon the heart. The chief characteristic of lillium is a bearing down sensation in the uterine region, as if everything would press out.

The mental symptoms are those of depression of spirits, an inclination to weep, timidity and apprehensiveness, is tormented about her salvation, has a constant hurried

feeling, as if duties were imperative, and an utter inability to perform the same.

Lycopodium.—This remedy acts powerfully upon the vegetative system, when its action is depressed, and when there are a slowly advancing weakness of functional power and a decay of tissue. It acts especially upon the mucous membranes of the respiratory, digestive, and genito-urinary organs, and upon the skin; but shows its most important local action upon the liver and the digestive tract, when there is a disturbed digestion, hepatic congestion, constipation, etc. The characteristic symptom of this remedy is an excessive accumulation of flatulence in the abdomen.

The mental symptoms are those of depression, with great anxiety, as if in the pit of the stomach; is fretful, vehement, angry, timid; the memory is weak, thoughts are confused; uses wrong words; there is a stupefying headache, worse from four to eight P. M., with vertigo in the morning, when and after rising, so severe that the patient reels back and forth.

Mercurius Vivus.—Acting upon every tissue of the body, alternating its functional power, both quantitatively and qualitatively, decomposing and destroying its organic constituents, increasing both secretion and absorption, and causing the secretions to lose their plasticity, and to become thinner and more fluid, and at the same time acrid and excoriating, this remedy resembles the effects of syphilitic poisoning. Its chief characteristic is an aggravation of all symptoms at night, and from the warmth of the bed.

The mental symptoms are those of weakness of memory, great anxiety, restlessness and apprehension, especially in the evening or at night; answering questions slowly. The head symptoms are those of fullness, and a feeling as if the head were bound around with a cord. The scalp is painful to touch, and there is a moist eruption on the scalp, and falling out of the hair.

Nux Vomica.—Nux vomica acts upon the spinal cord, including the motory and sensory centres at the base of the brain and gray matter, and affecting chiefly that portion

of the spinal tract which presides over reflex functions. It is so generally understood and used, that an extended analysis is unnecessary. In cases of melancholia, the stomach and intestinal disturbances call for this drug.

The peculiarity of the drug is its adaptation to disorders of digestion, arising from long-continued errors of diet and improper methods in general, when occurring in persons of sedentary habits.

Mentally, the patient is quarrelsome, ill-humored, and stubborn; sensitive to external impressions, can not tolerate noise, bright lights, or odors; morbidly sensitive, hypochondriacal, worse after eating, and in the morning, feeling better toward night, dizzy, heavy headache, as after intoxication. The head symptoms are better in a warm room, when sitting quietly, or lying down.

Phosphoric Acid.—The general sphere of action of phosphoric acid is upon the nervous system. The chief local effects are upon the kidneys.

Indications for the use of this drug are much weakness of memory, apathy, an apparent incapacity to think, and a disinclination to talk, accompanied by the passing of large quantities of pale urine.

Picric Acid.—This remedy has not been thoroughly proven as yet, but so far as the proving has gone, it is found to cause, when taken in poisonous doses, disintegration of the blood corpuscles, and softening and degeneration of the cortex cerebri, cerebellum, medulla oblongata and spinal cord, and consequent paralysis. It also produces inflammation of the kidneys, loading the urine with phosphates, urates and uric acid. Albumen and sugar are likewise found in the urine. In smaller doses there is at first slight congestion, which may vary from a feeling of fatigue to actual paralysis. Associated with this is a mental inactivity, lack of will-power, indifference to everything, and a desire to lie down and rest, thus simulating brain fag, neurasthenia, and sexual exhaustion, in which conditions is found its chief sphere of usefulness.

The mental symptoms are those of great indifference to

everything, lack of will-power, disinclination for mental or physical work, prostration on attempting any mental effort.

Pulsatilla.—*Pulsatilla* acts prominently upon all the mucous membranes of the body, and upon the synovial membranes, the veins, the eyes, the ears, and the genitive organs of both sexes; catarrhal difficulties, deranged digestion, and genito-urinary disturbances. The peculiarity of *pulsatilla* is that it is especially adapted for rheumatic inflammation and varicose veins when occurring in women of a mild, yielding disposition, and when inclined to weep easily.

The mental symptoms of *pulsatilla* are a mild, gentle, timid, yielding disposition, with inclination to weep; tremulous anxiety, as if death were near; anxiety about the heart in the evening, even to suicide; peevishness and capriciousness, though not vexed; hypochondriacal moroseness; out of sorts with everything; head confusion, with bruised pains; a hollow feeling in the head; vertigo as if intoxicated; headache, as from overloaded stomach, and pressing pains in forehead and above orbits, aggravated by raising the eyes.

Rhus Toxicodendron.—This remedy acts upon the mucous membranes, the lymphatic glands, the skin, the muscular tissues, and the tissues which compose the joints. The general effects of the drug when proved are those of debility, paralytic weakness, soreness, especially when sitting and at rest, great restlessness and uneasiness, must constantly change position, especially at night, sensitiveness to cold open air, to cold weather, and to northeasterly winds, itching over the entire body, and a red rash, like measles, covering the body.

Mentally, apprehensive and depressed; full of sad thoughts; desiring solitude; worse in the house, and relieved in the open air; anxiety, with great restlessness; fullness and heaviness of the head, with pressing down as if from a weight in the forehead; sensation as if the brain were loose, when stepping or shaking the head;

aching in occiput, which disappears on bending head forward or backward.

Silicea.—This drug acts powerfully upon the vegetative system, affecting especially the organic substances of the body, and involving prominently mucous surfaces, glandular structures, bones and joints. It is useful in paralysis, in paralytic weaknesses arising from defective nutrition, in spinal irritation, and in nervous affections following injuries of the spine, with chronic effects of fright, or of shock; when the surface of the body is tender to touch, and the spine can not bear the least jar or pressure.

The mental symptoms are difficulty in fixing the attention; mind confused; restless, fidgety, startled by the least noise; is very sensitive, despondent, melancholic; tired of life; irritable; outraged conscience; worry about trifles; headache rising from the nape of neck to vertex, violent in character; head is wet from profuse sweating at night; scalp very sensitive to touch; inclination to lie with the head covered up.

Sulphur.—The indications calling for sulphur are found in extreme emaciation, great debility, trembling, weakness and prostration, sensitiveness to the open air; taking cold easily, with offensive perspiration; dislike on the part of the patient to be washed.

The mental mood is that of depression; peevish, irritable and quarrelsome, with a mental and physical indolence; anxiety and apprehension, increasing toward evening; tendency to religious and philosophical speculation; uneasiness and involuntary haste in everything; mental distraction; cannot think, or fix the mind on any subject; headache is accompanied with great confusion, with dizziness, with aching, as if a band were tied around the forehead, worse when stooping, with rush of blood to the head; pressing headache in vertex, as if from a weight on top of brain.

In briefly referring to the remedies mentioned, I am indebted to the *Materia Medica* of Dr. A. C. Cowperthwaite, but only such remedies have been mentioned as

have been most commonly used in the treatment of melancholia at the Middletown State Hospital; and to Dr. Arthur Palen Powelson, assistant physician in this hospital, I am indebted for the statistics of one thousand cases which I present.

RECORD OF ONE THOUSAND CASES OF MELANCHOLIA.

Recovery, 50 per cent: male, $47\frac{1}{2}$ per cent; female, $52\frac{1}{2}$ per cent.

Death, $12\frac{1}{2}$ per cent: male, 14 per cent; female, 10 per cent.

Improved, $11\frac{2}{3}$ per cent: male, $10\frac{5}{8}$ per cent; females, $12\frac{1}{2}$ per cent.

Unimproved, $7\frac{1}{2}$ per cent: male, 7 per cent; female, 8 per cent.

Still under treatment, $18\frac{5}{8}$ per cent.

Melancholia Acuta, $91\frac{5}{10}$ per cent.

Melancholia Chronica, $8\frac{5}{10}$ per cent.

Melancholia Acuta, $44\frac{1}{4}$ per cent male; $55\frac{3}{4}$ per cent female.

CASES UNDER SIX MONTHS' DURATION.

FEMALES.		MALES.	
Recovered.....	39	Recovered.....	31
Improved.....	10	Improved.....	7
Unimproved.....	4	Unimproved.....	6
Dead	17	Dead	7

CASES UNDER ONE YEAR'S DURATION.

Recovered.....	80	Recovered	60
Improved.....	4	Improved.....	7
Unimproved.....	5	Unimproved.....	6
Dead.....	4	Dead.....	7

CASES UNDER TWO YEARS' DURATION.

Recovered.....	97	Recovered.....	76
Improved.....	16	Improved.....	8
Unimproved.....	5	Unimproved.....	5
Dead.....	8	Dead	12

CASES UNDER THREE YEARS' DURATION,

Recovered	40	Recovered	24
Improved.....	13	Improved.....	7
Unimproved.....	9	Unimproved.....	11
Dead.....	4	Dead.....	6

CASES OVER THREE YEARS' DURATION.

FEMALES.		MALES.	
Recovered.....	34	Recovered.....	19
Improved.....	15	Improved.....	9
Unimproved.....	11	Unimproved.....	2
Dead	14	Dead	12

Total number females still under treatment, 80.

Total number males still under treatment, 84.

Melancholia Chronica, $55\frac{2}{10}$ per cent female; $44\frac{8}{10}$ per cent male.

CASES UNDER SIX MONTHS' DURATION.

FEMALES.		MALES.	
Recovered.....	0	Recovered.....	0
Improved.....	0	Improved.....	0
Unimproved.....	1	Unimproved.....	1
Dead.....	1	Dead.....	0

CASES UNDER ONE YEAR'S DURATION.

Recovered.....	0	Recovered.....	0
Improved ..	0	Improved	1
Unimproved.....	0	Unimproved.....	0
Dead	0	Dead.....	2

CASES UNDER TWO YEARS' DURATION.

Recovered.....	0	Recovered.....	0
Improved.....	3	Improved.....	4
Unimproved.....	0	Unimproved.....	1
Dead.....	0	Dead.....	1

CASES UNDER THREE YEARS' DURATION.

Recovered.....	0	Recovered.....	1
Improved.....	3	Improved.....	1
Unimproved.....	3	Unimproved.....	2
Dead.....	2	Dead	4

CASES OVER THREE YEARS' DURATION

Recovered.....	5	Recovered.....	3
Improved.....	8	Improved.....	5
Unimproved.....	3	Unimproved.....	3
Dead.....	3	Dead.....	8

Total number females still under treatment, 7.

Total number males still under treatment, 10.

The following autobiographical history of a patient who suffered from melancholia is of unusual interest, and I

take the liberty of inserting it in this paper. Owing to the fact that the gentleman was well qualified by temperament, and by college and business training, to appreciate the character of his symptoms, it is all the more interesting. It was written at the beginning of a decline of mental exaltation, and before the patient had reached, in his recovery, the period of his habitual reserve:

MIDDLETOWN STATE HOMEOPATHIC HOSPITAL,

MIDDLETOWN, N. Y., May 25, 1896.

My dear Doctor:

In answer to the following questions in reference to my case;—how the attack came on, what my feelings were during the depressed period, and how the depression began to pass off, I respectfully submit the following:

The attack and the nature of my delusions it may be unnecessary to say are the logical consequence of my prior life.

Among the principal undermining causes are, as I apprehend, passion, ambition, appetite, compunction of conscience and worryment.

Among my earliest characteristics as a child was a violent temper, which was fostered by my fellows and young men who were in the habit of teasing children. I early became so proficient in profanity, both in French and English, as to be a source of much amusement.

My parents were exemplary in their teachings and example. Having attended the common school in the village from the age of five until twelve, I was taken into my father's store as a clerk. I soon got into altercations with my brother and other clerks because of their teasing habits and of their real or fancied imposition. I continued in that capacity until about fifteen when I manifested such dissatisfaction that my father considered a change advisable. He was a very busy and industrious man, but seemed to be always worrying about something. My mother's disposition was timid and gentle. I think I inherited to some extent timidity and the disposition to worry. I told my father on one occasion when he was particularly annoyed about some business matters that I would never be a merchant. He offered to procure me a situation in a mercantile house, which I sullenly declined. He then suggested sending me to the grammar school, and my father promised to put me through college, provided business warranted it. I was soon thereafter installed as a boarder with a friend, and attending the school. I was a very slight and weakly lad. My friend was particularly desirous to please my father, and to advance me in my studies as rapidly as possible. At the commencement of the season an examination was

held, and I stood next to the lowest, but he encouraged and incited me to study, often asking, as he did others, "Well, John, how late did you stay up last night studying?" I was pleased to say until eleven or twelve, or later as the case might be, which he would praise as commendable industry. At the end of the session he awarded me the highest prize for the greatest progress. The following fall I went to college, imbued with ambition so successfully nurtured by my friend, and with a debilitated constitution.

I took a general high standing, but excelled particularly in Latin and Greek. I was there one session. It was then proposed that I should attend the University, as being an institution of higher standing and nearer home. I was persuaded by a student to attend the competitive examination for a scholarship which would entitle me to my tuition free for the full course. I was complimented by the professor of the Latin and Greek classes by the prediction of success in that department, and resolved to capture, if possible, the medal which was to be awarded for the first time in my graduating year for the highest standing in those subjects.

There were two courses of study—the ordinary, and the special honor course which was far more difficult and extensive. No one was eligible for special honors unless he also took general honors in the ordinary work. I foolishly, and to my great regret ever since, undertook the Special Honor Course in the 2d, 3d, and 4th years. The examination in the two courses in classics at the end of the fourth year extended over six days, two of six hours each, and four of seven hours each. My competitor for the special honors was a professor in the Normal School affiliated with the University, a man double my age, and who has for many years since been an L. L. D. I fell exhausted at the goal, and for several years thereafter my prostration was such that existence was a burden. I was incapacitated for work mentally and physically, and very despondent.

I was then twenty-two years old. In the second year of the course two of my fellow students, one of whom became subsequently a minister of the Congregational Church, and the other a professor in a theological school in England, became interested in my spiritual welfare. I took the matter seriously to heart, felt myself to be a great sinner, and earnestly desired to become a Christian. I had many consultations with the pastor of the Presbyterian Church, but could not see the way of salvation. It was near the end of the session, and he advised me to consider the matter during the vacation. During that time I secluded myself a large part of the time, earnestly studying religious questions, and seeking conversion. The only result observable was that I became so conscientious that I was afraid to act, fearing I might transgress some moral law, and was so strict and hypercritical as to become, doubtless, a great nuisance to others. The following fall I united with the church. I have often

since thought that the session made a mistake in admitting me. For several years thereafter I was under the dominion of a very sensitive conscience, but without love. This was a great strain upon me.

During the summer after graduating, my father offered to send me to a theological or law school, or to procure me employment in some line of business.

On my return to the city, I entered the law department of the University, and indentured myself a lawyer.

I had been advised not to study for at least a year, but to look after my health.

I felt out of place in the law office, and have always felt that I have misused my vocation. I attended the lectures and the office, but was almost wholly unable, through weakness, to study. To aggravate the matter still further, at about the commencement of the law term I fell in love with a young lady whose father was wealthy. I was too proud to declare my love because of her wealthy station and because I felt no assurance that I would ever become even self-supporting, and I suffered myself to consume with ineffectual fires.

During the previous course it had been, for the most part, my custom to retire at 12 M., and to arise at 6 A. M. I was greatly troubled by insomnia that winter, and very melancholic. In the spring I resolved to quit the law and country, and to hide my diminished head and body in the largest city on the continent, determining that if I were to be a failure it would be away from my friends and associates.

I sacrificed all my prospects. A prominent wholesale business man of the city had repeatedly assured me that I need not worry about business when admitted to the bar, as he would see that all necessary business was forthcoming. Dr. principal of the University, had offered me a position, at his disposal, in a bank, which I was unable to accept because of physical and mental debility.

The Doctor had, subsequently, kindly said that if at any time I desired to apply for any position he would procure me, if necessary, fifty of the best signatures in the city. My father was at that time the largest and most enterprising merchant in the county, and could have influenced a fair law business, provided my competency would be equal to it. But in my melancholy state I kicked over the whole apple cart, and steered for New York, furnished with, among other recommendations, an introduction to a prominent lawyer and a director of the Y. M. C. A. He lost no time in presenting me to its secretary, one of the noblest Christians I have ever met. It was not long before I was immersed in the work of the Association, on various committees, attending or conducting prayer meetings nearly every evening in the week. I transferred my church membership to Dr. church, and took a class in the Sabbath school. Through another director, I soon obtained a situation in the credits department

of a wholesale house. The hours were from 8 A. M. to 7 P. M. The sales were then about \$400,000.00 daily, and the house was very busy.

I soon concluded that in leaving home I had jumped from the frying pan into the fire. With great suffering I endured the work until the following January when I resigned, hoping to procure a situation easier and more remunerative, and determining that if I were to starve to death or die from exhaustion, it would not be in the service of an enormous millionaire.

In justice to my father I will add that he had repeatedly told me that I should not deny myself any necessary comfort, as he would furnish me with means until self-supporting. But I had resolved that inasmuch as he had spent more upon me than upon any of the others of his fourteen offspring, I would either maintain myself, or die in the attempt. I think I came very near dying, and have often wished I had died at that time, for, like Beecher during the Tilton mess; I was for years "seated upon the ragged edge of despair." As my income was insufficient to pay expenses, I economized in my only available way, in either not taking any lunch, or a five or ten-cent one.

Failing to procure a situation in another house, I entered a law office, with a salary about sufficient to pay for washing and occasional car fares, but with the privilege of doing a collecting and such other business as one not admitted to the bar might transact.

I was constantly on pins and needles about earning sufficient to pay board. With the assistance, however, of an uncle, I succeeded in weathering the storm until July with about sufficient money left to pay fare home. When I reached there I was so exhausted that I could not speak aloud without great effort. I was, however, still determined to risk my life in New York, and with money which I was obliged to accept from my father, returned the following September. Not long after, I became a clerk in a law office at a salary barely equal to necessary expenses. I resumed the study of the law, and continued with Mr. about thirteen years, pursuing in my studies an extensive course prescribed by Dr. Dwight of the Columbia Law School. In connection with my daily duties, the work was sufficiently trying. My capacity for study was greatly diminished, but I forged ahead with all my might, desiring to pass a creditable examination for admission to the bar.

I qualified as a citizen, and in the following September was admitted to the bar, and entered into partnership with Mr. He was a good lawyer, but so cautious and timid in practice, that I generally felt as though a dynamite bomb, or some infernal machine was somewhere concealed under him that was liable to blow up at any moment. I was very uncertain and restless in my work and knew that my faculties were over-strained.

Not long prior to my admission to the bar, feeling the pressure of overwork, I went to Brooklyn to board, with a view of severing my

connection with the Y. M. C. A. and certain mission school work, and of resting.

The room I secured, contained two beds. Shortly thereafter I received a letter from my sister, saying, in substance, that..... had left under a cloud, and advising, if he came to New York, that I should not welcome him. I resided in the same house with him at home four years. He was somewhat intemperate. He soon called, saying that he had no other acquaintance in the city, was without means, and was looking for a situation. He had many good qualities, and I had always felt friendly towards him. I remembered my sister's advice, but concluded to accept him as a room-mate, purposing to have him attend with me Beecher's Church and the Bible class, and in the fall, on my return to New York, the Y. M. C. A. He was pleased to hear Beecher, but kicked at the other benevolent efforts, and would, despite my preaching, take a glass too much at times. The result of our intimacy was disastrous, as I eventually found it more pleasant to go to the beer-saloon or to smoke than to go to the Y. M. C. A., or the prayer meeting. I improved, however, in weight and physical comfort. I still maintained my church relationship, and delighted in the Sunday services. But I must say that for comfort on a warm summer's evening a stein of ice-cold lager with an occasional schweitzer kase sandwich or pretzel in a fine beer garden excelled most anything I had ever tried. I, however, did not take out of it all the pleasure of which it was susceptible, because of my felt inconsistency. Suffice it to say that the habit of drinking and smoking grew upon me in the ordinary way, and altered the character of my friends and associates. I lost my ambition for study, for success in the profession, and ceased to care whether I had more or less money, provided I had enough to pay current expenses.

I had resolved when I left home never to marry, and had ever since avoided ladies' society as much as possible. But the plans "o' mice and men aft gang aglee," or something of that style.

It was agreed about September 1st that my friend should visit and make a list of a few eligible city boarding-houses, where there were no young unmarried ladies, and that I should select one from it. He reported but one, at which I called and found everything satisfactory, excepting that there was one young lady boarder there who, the landlady assured me, was very quiet and pleasant, and not dangerous. On the first view of the young lady in question I felt that there was something extra-hazardous around somewhere in the vicinity, and resolved not to hang about the house evenings, but to occupy them in attendance upon lectures and various public entertainments. During that spell I heard many distinguished orators and statesmen, but somehow felt an abnormal attraction for home. We were married in the fall, three years later.

My purpose was to induce her to become a professed Christian and a member of the church, but I find that a man who marries, assuming to mold a woman to his will, doesn't know what timber is. This only difference, I may say, was a source of worryment to me. But now I surmise that God in His infinite love and wisdom has also removed this obstacle to our happiness, for I find in her letters during my late sickness such expressions as "John, if you will only get well, we will start out anew; read closely the enclosed sermon by Dr. Lyman Abbott, and tell me what you think of it; that's the kind of religion I believe in; I intend to read the whole course. Consider that the Lord is speaking to you through me; this trouble has taught me a lesson."

I quote the substance from memory. I am happy in the hope that we are now one in a larger and nobler sense than ever. I express no judgment on Tolstoi's theory in relation to the sexes, but believe that its practice would in many cases be beneficial. I also believe that boys should be plainly informed as to the sinfulness and evil consequences of a certain habit. I once heard a celebrated English orator utter the sentiment: "A vicious principle in a constitution is seminal revolution;" another, an American, the sentiment: "Every violation of a natural law has registered in itself its own damnation."

In January....., Mr..... and I dissolved partnership, and in the following June I was engaged by..... &..... as managing clerk, with the privilege of retaining my clientage. I found that the duties and responsibilities of managing clerk in a large metropolitan law office were no sinecure.

Mr..... died in June....., and I continued with his successor, Mr....., until my collapse in.....

In October, having been for some time alone in charge of the office and the business of somewhat unusual responsibility, I broke down, and was taken to an asylum, where I remained until the latter part of August.

For many months prior, nearly all business and everything worried me to an unusual extent. I became very nervous, sleepless, undecided, and bewildered about matters even of trivial importance, and lost confidence in myself. Imagination was let loose, impressions once made became indelible, my accounts examined more than once from different standpoints of view appeared to contain wrongfully duplicated entries; particular views of cases became exaggerated into undue prominence to the exclusion of other considerations, and chaos worse confounded gradually reigned as to all things terrestrial, celestial, material, spiritual, subjective and objective, past, present and future. I believed no one, and am thankful that no one believed me. There were lapses of memory as to some events, while others stood out remarkably distinctly; hearing became abnormally acute; every act of my life seemed to appear distinctly in conscious-

ness; I had forfeited all rights, human and divine, and was a self-convicted, appalling hypocrite. I apparently lost every vestige of affection, but clung to and followed my wife about like a little pet spaniel.

In this condition I was taken by her to a farm-house owned by her friend, His exemplary demeanor, and the administration of his household impressed me that it was such a home as would prevail during the millenium, which I believed was soon to be inaugurated. We were there a week or two during which there were three remarkable occurrences, which I will mention.

One day I started alone for the fields. As I looked toward the adjoining farm I saw, or seemed to see, on the other side of the fence, a distance of two or three acres, a neatly dressed young man run a short distance in the direction I was going, looking at me and suddenly disappear. I appeared to see him as distinctly as though he were only a few feet away. The impression was vivid, but soon forgotten. I thought I was being watched.

Another day I walked to the rear end of the house. As I looked towards the highway I beheld three men of unusual stature, dressed alike, walking with rapid and extraordinary strides westerly. They suddenly halted on the top of the hill, faced about in military style, looked at me a few moments, and resumed their march down the hill. I have since had the impression that they were Jesus, Moses and Elias. This presentation also soon disappeared from memory.

On another occasion when my wife proposed to pay an assessment to the Royal Arcanum, in which my life was insured, to which payment I objected upon the ground that I had forfeited all rights under the provisions of its charter, constitution and by-laws, I told her a falsehood, which I thought was the first one, but have since concluded I must have been mistaken. Immediately, apparently, something grayish snapped a few inches from my head, an extraordinary sensation went through my body, and the impression came that there was no longer a conflict within me between good and evil, but that I was then uniform in iniquity. Immediately afterwards I appeared to others to be recovering.

As stated above, I was taken to an asylum in November. While there and for some time prior I writhed nearly all my waking hours in mental and spiritual agony, became further deluded, conceived that my marriage was illegal, disallowed of the Scriptures, that I was the Anti-Christ with all his qualifications, either actual or incipient, all his responsibilities, and subject to his pronounced doom; that the fact would be shortly made public with great rejoicing all over the earth, and that the millenium was at hand.

I had a vision of the lake of fire and brimstone, of being cast into it in the presence of representatives of all governments and of an innumerable host, and of the first resurrection as predicted; of being

crucified on an eminence head downward in the view of rejoicing multitudes. I thought I had committed crimes, the penalties for which under the New York statutes would easily amount to a thousand years' imprisonment, and that I was being retained at.....until an appropriate subterranean dungeon was built at Sing Sing to accommodate me; that I had broken my original covenant with God, and many renewals of it

Some of the physical symptoms, some of which existed prior to my committal, were the following: The lower part of the brain became warm, the sensation extending down between the shoulders. I became delirious. Looking at the sun one day, I felt that with each revolution of the brain I was approaching nearer it, and was soon to be absorbed by it, there to remain in perpetual fire. I felt that the portion of the brain which was the seat of conscience had become void; became more nervous and sleepless; the finer instincts were apparently extinguished, and the baser faculties were dominant. I became awfully profane and filthy in imagination, thought, and action. I frequently thought of prayer, because even in the midst of iniquity and inconsistency I had never remitted it. But at and for some time prior thereto, it was continually impressed upon me that the prayers of the wicked were an abomination to the Lord, and that if I prayed, some summary severe punishment would be visited upon me.

About April 1st I was alone in my room in terrible agony. The resolution suddenly came to me to pray to God even though He should slay me. I knelt and covenanted with Him that if He would forgive and restore me I would thereafter do my best to serve Him. Immediately power came to me, and for the first time in my life I was conscious of the answer to prayer. From that moment my recovery was so rapid that the physicians wondered at it. There came a violent swirling of the brain, which alarmed me; there was something in it behind the eyes, which, as I fancied, had given to natural objects their weird appearance, dissolving, and, as the natural aspect was being resumed, the diseased impressions and delusions receded until a normal condition was reached. Dr....., as I learned on returning home, had refused to encourage my wife and friends that I would recover. In July, at his suggestion, I visited home for ten days. He intended to retain me longer, but Mr. desired me to return in the latter part of August to take charge of the office in his absence during the month of September. It was finally so arranged, as I considered that there would not be much business to attend to, but in this I was disappointed. I felt the strain severely, and became very nervous and unsettled. I, however, continued until my subsequent collapse, eight years later. My intellectual faculties were restored, but the coldness that had

come over my emotional nature had not disappeared. My daily tasks were tedious; my brain was weak.

Some time after my return, perhaps six months, I made a social call with a friend on an old Scotch gentleman in Brooklyn, and was with little persuasion and through courtesy induced to take a glass of whiskey. The next day I called at a drug store and had a glass of Calisaya wine. It soon became a habit to take a glass of wine on the way home from business and during the day; then to drink lager. In the course of time lager did not fill the bill, and was supplemented by gin and seltzer. The long standing habit of smoking during the evening four or five cigars had not been remitted. I do not think I was considered intemperate, in the usual acceptation, by my friends, as I was always on hand for business, apparently respectable in deportment and associates, but I felt the disqualifying effects, became more nervous and irresolute in business, found it difficult to concentrate upon work, avoided as much as possible responsibility, often revised my work several times to be sure that I had made no mistakes, often, after having closed the safe and the office, returning to be sure that I had properly done so.

In September, 1893, Mr. went to the World's Fair, and left me in charge of a complicated matter in which several banks, trust companies, and individuals were concerned. I had hoped to stave things over until his return, but they began almost immediately to culminate. I felt the strain, and my worriment increased. The result was my collapse.

The first physical symptom was the heating of the back of the brain. As soon as I realized my condition I stopped abruptly all stimulants, except tobacco. Sleeping medicines had little effect. The general symptoms were in the main similar to those prior to my former experience.

One night, as I awoke, I felt the upper and lower part of the brain part and a vertical slit in it, from which a breath passed through the nostrils. This was, I conceived, the departure of the soul from the body and spiritual death, and I cried to my wife that I was doomed and everlastingly banished from God.

A night or two after, while abed, a peculiar sensation ran along the spinal column and diverged to each lobe of the brain. I conceived that I had thus descended lower than the beasts. I became apathetic, and lost all care for my family. I became exceedingly depressed, and resigned my position in the office. I placed myself under the care of Dr. His theory was that the gin had poisoned the food, and so affected the brain. He prescribed cathartics, and gave me little pills which he appropriately called "little devils."

Some one suggested consulting Dr. He advised taking me to a sanitarium, and gave my wife a list of places, suggesting as the most likely When I reached there, which was in the early

part of October, I was placed in charge of an attendant, whom I instantly recognized as the exact counterpart in every particular—countenance, cap, clothes, and everything—of the man I had seen nine years before running along the fence at He was at that time, and for many years after, in England. I was in a state of terrible nervousness, wild in action and speech, and at times yelled vociferously. The following Sunday morning I performed a war dance in the rear of the house, which amused the patients very much. A strait-jacket was several times for short periods placed upon me.

Eventually it was deemed necessary to remove me to another building, and keep me in a jacket several hours, Drs., and another, and two attendants standing guard. I was laid upon a bed. Suddenly a demoniacal spirit seemed to possess me. With a voice loud enough to resound across the valley it damned the sun, moon and stars, the earth and sea, and all that therein is, charged God, the Father, Son and Holy Spirit and the Virgin Mary with the most infamous crimes, damned the churches and all that dwell therein, accused the doctors as frauds, blasphemed in French and English, and uttered expressions in Latin, Greek, Anglo-Saxon and Gaelic. This continued several hours despite the efforts to stop it.

The word used that had afterwards, perhaps, the most terrifying effect upon me, was the Greek "apparaskuastotatos," the most unprepared possible, used by Xenophon in the *Anabasis* to describe the confused condition of the Persian Army in its advance upon Greece. I considered it was intended to describe my physically and spiritually lost condition.

I will not undertake to set forth the conditions of my brain and general condition, except as indicated by the symptoms of which I gave a sample.

One day a serious question was mentally propounded to me, in which I was asked as to certain events in my own career: "Was it right?" The answer was in each instance: "No," concluding with the admission that the judgment of God upon me was just, and daring Him to do His damndest.

I stated while in the camisole that I was doomed to infinity upon infinity of punishment throughout eternity

Standing with Dr. one Sunday morning on the piazza, I told him that I was responsible for the fall of Adam and Eve, and for the sins and woes of all men for all time.

On another occasion I saw the whole valley filled with the livid, wriggling mass of my sins in the form of a cone, the top of which reached to the heavens. I believed I was Satan.

At another time, as I awoke early in the morning, I felt a change proceeding in the brain and body, and was impressed with the idea that my nature was being assimilated to that of a hog, and that it was the devil's nature.

Another morning as I awoke there appeared before me, as though objectively, a disc about one and a quarter feet in diameter, perfectly black, excepting a small bright segment on the lower edge, which I have since inferred intimated that God had not wholly left me.

I became quieter towards the first of January, when my brother took me to Brooklyn on a five days' parole, which was subsequently lengthened to March 1st, when I was brought here.

Dr. 's idea had been to give me as much exercise as possible, and, consequently, I was, for the most part by two attendants, I may say dragged, driven and beaten up and down steep hills, and along roads eight or ten miles a day, to the exhaustion of what little nervous force I had left.

I believe if I had been brought here at first and strapped, if necessary, to a bed, it would have conserved my energies and promoted my recovery, and saved me from the disgrace, as well as the fatigue, of being maltreated and dragged through the streets.

On my arrival here, and for a long time after, my brain felt as though it rested on a cold slab of marble. At. and at home a constant change proceeded in it, which continued, I think, until after I reached here, by which I conceived I was being thoroughly demonized. I lost, apparently, all nervousness, and thought I had been fitted for infinite and eternal torment, believed that my spiritual being which was commensurate with my physical being had been transferred to another region, and that Satan who had invested me in the form of a small grayish dragon on the occasion at the farm and been driven out at. , had re-invested me; that my skull was his residence and rendezvous in which he was still concocting, and from which he went forth occasionally to endeavor to perpetrate his nefarious designs against God's kingdom; that this was an eleemosynary institution to the care and protection of which I was not entitled; that I had forfeited all rights, human and divine; that the only ones so far let into the secret were Dr. , Gov. Flower, and some of the State authorities, and a few others; that I was liable at any time to be transferred to Sing Sing, there to be chained and imprisoned for one thousand years, or to be cast into the "Mouth of Hell," in the Riff Mountains in Africa, and so into the molten mass in the centre of the earth, there to abide in everlasting solitude and agony, or to be publicly crucified, head downwards, and that when it was found that death was impossible, to be cast into the bottomless pit, and a stone rolled over it, and a seal put upon it; that thereupon it would be proclaimed to all nations and demonstrated that Satan had been caught and bound; that the Jews, heathen and all people would be convinced of the verity of the Scriptures, and the day would arrive in which every man who should call upon the name of the Lord would be saved, and the millenium would with such rejoicing as never before existed on earth be inaugurated, with the rising

of the martyrs from the dead, and with all its characteristics, incidents and concomitants in fulfilment of the prophecy. When Gov. Flower visited here during the summer of 1894, as he looked toward me, he happened to smile, which was evidence to me as strong as Holy Writ that he was "dead onto me."

I believed that, as Satan, I had instigated the crucifixion of Christ; that now there was rejoicing in heaven because the accuser of their brethren was cast down; that now had come the day of salvation. I was conscience-stricken as to the unfaithful discharge of my duties as husband, father, citizen, and member of society, and as to every act of my life. I saw that the heavens declared the glory of God, and the firmament showed His handiwork, and the wonders of creation dawned upon me with somewhat of their designed revelation, but I was rebuked of all things. My wife stood next to the Virgin Mary in nobility, and my children were exalted among the redeemed. I was lower than the beasts, and the disgraced one of the universe. I believed that my personal and family history corresponded exactly with the revelation as to Satan; that a stone was to be tied to my neck, and I cast into the deepest part of the sea; that, being incapable of death and bursting, I should ascend to the surface as the seven-headed and ten-horned dragon, and be visible at times to mariners and voyagers on the sea.

Deeming that I was so irrevocably doomed, I one day made in legal phraseology what purported to be a contract with the Almighty, providing in substance that in consideration that he would cure and save all men I would suffer the consequences of all their sins, so that even the unrepentant might go free, and I subsequently conceived as patients were discharged from this institution, he was fulfilling the contract on his part. I considered that in this way he had in his infinite wisdom found a way by which none should be lost except me. I believed that Christ had never intended to include me in His redemption plan. Until about the middle of last February, I was convinced, that I comprehended within me the trinity of evil, Satan and the Beast and the False Prophet; that I had been cast out of heaven down to the earth by the Archangel Michael and was the cause of all death, labor and woe not only upon earth, but throughout the universe, wherever Satan may have wrought, and that all evil spirits were my dupes. I conceived that God and all celestial and terrestrial beings, all the fallen angels and all forces natural and spiritual were arrayed against me. As at.....so here I was convinced that I had committed the sin against the Holy Ghost.

In the winter of 1895 I wrote Mr.that there had occurred in me a substitution of individualities; in other words that I was the victim of complete diabolical possession, and doomed to infinite and eternal torment in the flesh upon the earth, and offered to surrender myself to the District Attorney of New York or Kings county, or to

any power or authority, to be tried upon the charge of being the Anti-Christ, and upon any other charge, and to plead guilty to all true charges.

You once said that if you had a dollar for each of my delusions you would be the richest man on earth. I affirm that there was in this statement no exaggeration whatever. How could it be otherwise as to all things when my mental and spiritual visions were so distorted?

I would like to present my physical feeling during the depressed period here, but lack the language of analogies to do it.

I suffered, I may say, no pain, but my body was an awfully distressing burden, and appeared to fulfill the Scriptures: "Ye have become as brass and iron and copper. I will break you in pieces, and cast you into the furnace in my fury."

I was in a physical, as well as mental and spiritual, hell. The first symptom of recovery, from my standpoint of view, was in the early part of this year, a conscious improvement of the body, which appeared to be approaching a more natural condition. The strapped feeling of the head became gradually relieved. For some time there were alternations of improvement and depression, until finally the depression ceased.

One day in February as I sat in the westerly day-room, I experienced for a few minutes what occurred to me as a natural condition. I reflected that God had, perhaps, not finally forsaken me, when I immediately fell back into the old slough. On two or three occasions I felt for short periods motions of gratitude toward God. One Sunday evening in the latter part of the month I had, after smoking, a terrible attack in which I was as sure as that the sun shines that I was Satan and the Beast and the False Prophet, the trinity of evil of the Apocalypse. The resolution then came to me to cease the habit of smoking. The next day I was more comfortable. I may have taken in all, at intervals of a day or two afterwards, a dozen puffs of a pipe, but soon lost all desire for smoking. I think if I had at once obeyed your direction to cease smoking, my recovery would have been hastened, but it might have been necessary to furnish me with wrought iron nails or something similar, to bite the heads off in my agony.

The following (I think) Wednesday night as I retired I had another attack. My body felt, if such a simile can express it, like a dried husk, in which there was nothing useful or salvable. The feeling was distressing in the extreme. I concluded to resume prayer to God. In my pleadings with Him, I promised implicit faith in the Scriptures as His revealed will, that they declared, "If any of you lack wisdom let him ask of God that giveth to all men liberally and upbraideth not;" that Jesus had said, if a son ask of his father bread will he give him a stone; if ye, then, being evil, know how to give good gifts unto your children, how much more shall your Father which

is in Heaven give good things to them who ask Him. I urged my ignorance and deplorable physical and spiritual state, and, citing these and like authorities as I would decisions of a court of last resort, I claimed their fulfilment on my behalf. There being no apparent response after repeated entreaties, I further entreated that, if my faith were lacking, the requisite faith should be given me. I apprehended that the only spiritual power I had was to ask for what I conceived necessary.

A week or so after, Sunday morning. I seated myself in a rocking chair near the door leading into Annex No. 1, feeling more composed, and intended to remain as quiet as possible. I began to reflect upon God, His fatherhood, His love as manifested in Christ and in creation and upon kindred subjects, when suddenly there came to me such wonderful and glorious conceptions, such exaltation and rejoicing and blessedness as I had never even conceived of. The whole heavens and the whole earth seemed to burst forth into praise and thanksgiving. I perceived and felt the fatherhood and love of God, the efficacy of Christ's atonement for my sins and the sins of every man, and was assured and have never since doubted that the prodigal was then and there received with infinite blessings by his Heavenly Father.

As you passed through to the Annex with Mr. you greeted me with a "Good morning, Mr." and, turning to the attendant, said with manifest pleasure, "the sight of that man's countenance will make me happy all day." I perceived that God had not only made me happy, but had already used me to promote the joy of others.

That Sabbath I shall never forget, for I was without the least apparent effort on my part, the theatre of "Glorias in Excelsis," and most wonderful and glorious revelations. There were recitals of part of the 103d Psalm, "Bless the Lord, O my Soul, and all that is within me bless His holy name. Bless the Lord, O my Soul, and forget not all His benefits; who forgiveth all thine iniquities; who healeth all thy diseases; who redeemeth thy life from destruction; who crowneth thee with loving kindness and tender mercy; who satisfieth thy mouth with good things; so that thy youth is renewed like the eagle's;" and of the 23d Psalm, "The Lord is my Sheperd; I shall not want. He maketh me to lie down in green pastures; He leadeth me beside still waters. He restoreth my soul; He leadeth me in the paths of righteousness for His name's sake. Yea, though I walk through the valley of the shadow of death, I will fear no evil; for thou art with me; thy rod and thy staff they comfort me. Thou preparest a table before me in the presence of mine enemies; thou anointest my head with oil—my cup runneth over. Surely goodness and mercy shall follow me all the days of my life."

I reasoned that if the love and wisdom of God were sufficient for my salvation, then no man need despair, and that He saw something salvable in every one, however impregnated with iniquity. I rejoiced

in the fatherhood of God and the brotherhood of man. But my stay upon the Mount of Transfiguration was soon to terminate, and, like Peter, James and John, I had not far to go to meet lunatics at its base.

I have since had no recurrence of delusions. I am firmly convinced of the fact of the new birth as taught by the Lord Jesus, and of the essential verity of the Holy Scriptures. Verities resisting in conception merely have now possessed my whole being, and God's omniscience and superintending care and love have been demonstrated. I have wept over the ambitious, blinded, foolish boy wending his devious paths to two asylums, but I rejoiced in the glorious consummation. My trial has been longer and severer than at "When the unclean spirit is gone out of a man, he walketh through dry places seeking rest; and finding none, he saith, I will return into my house whence I came out. And when he cometh, he findeth it swept and garnished. Then goeth he and taketh to him seven other spirits more wicked than himself; and they enter in and dwell there, and the last state of that man is worse than the first."

I present the foregoing from the ocean of my experience as a sample of some of its ingredients. If I were opposing counsel regarding it as a testimony, I should move the court to strike out parts of it as irresponsible. If still mad, I think that, like Hamlet, it is but nor' nor' west, and that when the wind blows southerly I can tell a hawk from a hand-saw.

I trust that this is the last time I shall have occasion to use the pronoun "I" so frequently in so short a space.

You persistently, against my contention, predicted my recovery, to the great encouragement of my wife, family and friends, and are entitled to judgment in your favor with costs and the extra allowance of costs permissible by statute in difficult and extraordinary cases.

It is with some difficulty I have unlocked the storehouse of memory, held up in consciousness and presented such singular experiences, as matters for the most part of a healthful nature now engross my attention. I am profoundly grateful not only to God, but to all His servants, in my physical, mental and spiritual regeneration.

I close this imperfect narrative with Faber's hymn:

"There's a wideness in God's mercy,
Like the wideness of the sea;
There's a kindness in His justice
Which is more than liberty.

"There is welcome for the sinner,
And more graces for the good;
There is mercy with the Savior,
There is healing in His blood.

"For the love of God is broader
Than the measure of man's mind;
And the heart of the Eternal
Is most wonderfully kind.

"If our love were but more simple,
We should take Him at His word;
And our lives would be all sunshine
In the sweetness of our Lord."

VISITING IN HOSPITALS FOR THE INSANE.

By R. M. ELLIOTT, M. D.,

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Visiting in hospitals for the insane is an element which demands not a small proportion of the time and attention of medical officers, time which, in many instances, might be spent more profitably some other way.

Two sets of people are included under the head of general visitors—those who are not relatives or friends of patients, the so-called “curiosity seekers,” and those who are relatives or friends.

Every one is familiar with the ways and manners of the former. “Let us see the violent ones?” “Is that one dangerous?” “What is his mania?” “Is she incurable?” etc., are expressions familiar to all employed in public hospitals for the insane. Visitors of this kind should be excluded as much as possible, and when admitted at all, restricted to a small area of the building and not given access to the disturbed wards. They should be kept moving and a strict reticence observed on the part of the officer accompanying them, so far as anything appertaining to any patient's condition is concerned.

Visiting by relatives or friends of patients is of course an entirely different matter, and, in most cases, is to be encouraged, within certain limits, rather than deprecated. Rules governing this class of visitors vary at different hospitals, as do also facilities for their reception. It is the policy of some to have them shown to a reception room and the patient brought there from the ward, and of others to conduct them directly to the ward where the patient is, regardless of its character or location. Each has its advantages and disadvantages.

It can not be denied that considerable prejudice still exists in the minds of the general public as regards the treatment of the insane, although not to the extent that it did formerly. The public press is, perhaps, in a large measure to blame for this, especially those publications of the type

alluded to by Dickens, which he termed the "New York Sewer" and the "The Rowdy Journal," publications which never fail to associate cells, padded rooms and strait-jackets with institutions for the insane.

Visiting is undoubtedly one of the best media through which to correct public sentiment. Where friends are shown into a reception room in or near the administrative department and not permitted to see that part of the building where the patient actually lives, they are apt to go away entertaining apprehensions for which there is in reality no ground, whereas if they were taken directly to the apartment of the patient and given an opportunity to inspect the ward and its accommodations, prejudice is often removed.

But there are evils attending the latter method. It is necessary in many cases to maintain a close supervision over visitors as well as patients. This can not be done as effectively when they are scattered through the wards and rooms. There is a tendency on the part of some to furnish patients with articles which they should not have, such as matches, knives, scissors, spirituous liquors, etc., and to obtain signatures to legal or other documents, when not consistent with the best interests of the patient. Sexual relations may occur between man and wife, and women have been known to become pregnant while under the care of a hospital. Then, too, the exciting influence of strangers upon patients of the disturbed class demands that certain wards should be closed even to relatives.

On Christmas day of 1895 a man came to the Brooklyn department of the Long Island State Hospital to visit his wife who was suffering from sub-acute mania. He had been in the habit of visiting her at intervals of two or three weeks for several months, and as usual was allowed to enter the ward where she was. They took seats in a single room but, in accordance with requirement, the door was kept open. A few minutes later the report of a revolver was heard and the patient ran out and down the ward. An attendant who was standing only a few feet from the door

of the room at once approached and as she did so a second shot was fired. The man had shot himself in the head and died within twenty-four hours. The first shot was aimed at the patient who received only a scalp wound however, but which was followed by intense inflammation and suppuration, several weeks elapsing before the wound finally healed. A fact worthy of mention in connection with this is, that her mental symptoms cleared up almost immediately after she was shot, and she was subsequently discharged recovered.

On another occasion a woman, afflicted with melancholia, was visited by her husband, who brought some delicacies for her and a table knife to use in eating them. He neglected to take the latter away, and it was concealed by the patient. She attempted suicide the following night by cutting her throat.

The extent of visiting differs greatly in different hospitals of like capacity, the controlling influence being the location of the institution and its accessibility. At Brooklyn visiting days are Sundays and Wednesdays. The average number of visitors on Sundays is 400 and on Wednesdays 200. They are required to obtain a pass from a medical officer before being admitted to the ward, and their visit is recorded in a book kept for the purpose. The number of patients is 1,300, almost all of whom are residents of Brooklyn. The buildings are antiquated, each ward consisting of a corridor running through the centre with rooms on both sides. In modern buildings with their day rooms, dormitories, and congregate dining rooms, it is obvious that better supervision can be maintained over both patients and visitors and such irregularities as referred to above detected more readily. Discrimination should be made in this matter, but where there are so many coming at the same time it is difficult to make exceptions.

SOME GENERAL CONSIDERATIONS ON THE METHODS OF INVESTIGATING AUTO- TOXIC DISEASES.

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That all living organisms are manufacturing toxic substances, poisons, every moment of our lives, in a state of health or disease, is a very well established fact; that these auto-toxines are frequently the causes of different diseases is admitted by every medical authority. It is not my object to discuss the conditions under which the toxines manufactured in the organism in a state of health cease to be indifferent to functions of the organism, cause different diseases, nor do I desire to discuss the conditions under which poisons abnormal in quantity or quality are formed in the organism and thus again give origin to different diseases.

Many of these questions, and particularly the great importance of the relation of auto-intoxications to the production of mental and nervous diseases, have been discussed in a previous issue of this Journal by Van Gieson.*

Basing his interpretations of neural auto-intoxications upon objective studies of the ganglion cell, rather than upon the more purely theoretical and at present rather vague considerations which students of mental disease are often constrained to put forth in lieu of no explanation of the cause of many forms of insanity, this writer presents a definite and tangible ground for the importance of auto-intoxications in the production of neural disease in demonstrating and interpreting the *morphological changes in the nerve cell induced by the action of auto-toxines*. This observer shows that the nervous system is the most sensitive of all of the body-tissues to toxic substances in

* The Toxic Basis of Neural Diseases,—Remarks on the Relation of the Auto-Intoxications to Neural Diseases. STATE HOSPITALS BULLETIN, Vol. I, No. 4.

general; that the auto-poisons, in common with other toxic substances, produce acute or chronic parenchymatous degeneration of the nervous system as in other parts of the body, or, as he specifically terms the process, cytolysis and cytoclasis of the nerve cells. Furthermore, while the morphological changes in the nerve cells due to auto-poisons are not characteristic nor essentially different from the action of other classes of poisons, Van Gieson outlines a method of identifying auto-toxic disease from the morphological standpoint by the process of elimination of the action of the several other classes of pathogenic substances, since these have certain specific and tangible characteristics not present in the auto-poisons. At the same time he insists on the value of the correlation of morphological studies with the methods of investigation from the standpoint of physiological chemistry.

These views constitute a very important impetus to an advance step in the study of auto-intoxications, for hitherto we have had but little positive knowledge of the morphological changes due to auto-toxic substances, or at the most no such comprehensive interpretation of changes in the nerve cell associated with auto-intoxications as given in Van Gieson's paper.

It is not, however, my purpose to include this method of investigating auto-intoxication from the morphological standpoint combined with the process of excluding the presence of other classes of pathogenic poisons but to limit myself to the present methods of detecting the auto-intoxications or the toxins causing different diseases from the standpoint of physiological chemistry.

But before describing the chemical and experimental methods of detecting auto-intoxications, it will be useful to indicate briefly the scope of research in the mentioned line.

Do our present methods directly prove the causation of certain diseases by certain toxins manufactured in the organism under certain conditions? Can any disease be reproduced by toxins found in the organism or elimination by it during the disease? Or does the analysis under

present methods only give us sufficient ground to presume that certain diseases are due to accumulation or hyperproduction in the organism of normal toxines, or to the formation in the organism of some toxines absent from it in a state of health?

A correct answer to this question is clearly of great importance to those who intend to direct their research to the field of auto-intoxications. He who attempts to reproduce a disease by toxines present or eliminated by the organism during a disease will probably be discouraged, and most likely fail, and still all medical authorities at present do acknowledge auto-intoxication as the cause of many diseases.

The idea of auto-intoxication was first expressed in connection with the nervous symptom-complex occurring during Bright's disease, and known as uræmia. Urine has always been considered toxic and uræmia presents certain symptoms coinciding every time with retention of urine.

But, evident as the case was *a priori*, the adherents of the chemical theory of uræmia always failed to find a single substance present in normal urine that could be held responsible for all the symptoms of uræmia.

Urea was the first to be considered as the agent causing the symptoms of uræmia. And, indeed, the blood and tissues of uræmic patients contain considerably more urea than those of normal individuals.

However, urea has never been found in quantities actually sufficient to kill an individual. In cases where urea was injected in the blood after nephrectomy, so as to prevent its elimination, death did not occur sooner than after a simple nephrectomy.

The theory of urea was thereupon modified by Frerichs, who held that the urea accumulated in the organism is being decomposed into ammonium carbonate, which is the cause of all the nervous symptoms known as uræmia. But that salt was never found in the organism in quantities sufficient to produce death, and on the other hand the

symptoms produced by ammonium carbonate, when introduced in an organism in really toxic doses, are entirely different from those of uræmia. And then, as Pashutin remarks, nephrectomy or ligation of the ureters causes death also among birds, who do not produce any urea at all.

Further, there was not a single constituent of normal urine, organic or inorganic, that was not considered by some author as the cause of uræmia.

But none of them was ever found in uræmic patients in quantities sufficient to produce death and none of them, when injected in really toxic doses, could reproduce all the symptoms of uræmia. Later, when the research of animal alkaloids so greatly engaged the minds of many medical authorities, and when Gabriel Pouchet discovered also alkaloids in the normal urine, many ascribed the most important rôle to these agents, but the arguments used in criticism of the other theories apply with equal force to that of the alkaloids.

Injections of all the organic substances of urine and even of urine *in toto* also failed to reproduce the entire symptom-complex of uræmia.

The question then arises: If we failed to discover a poison or a sum of poisons reproducing uræmia, have we any ground or reason to assume auto-intoxication as the cause of that disease?

That we have it, was proved by the experiments of Bouchard, which show that the urine of uræmic individuals is considerably less toxic than that of normal individuals.

Why this is so, is easily understood. Some toxic substances usually eliminated by the kidneys are being accumulated in the organism and cause nervous attack known as uræmia.

Just what the substances are is very hard to say. Bouchard says that uræmia is a mixed poisoning "*not by urine* (as it is being inaptly called) *but by what should have become urine.*"

That is very true, though it seems to me that even Bouchard does not ascribe sufficient importance to the determination of uræmia.

His definition seems to imply that uræmia is caused by constituents of urine, which, instead of being normally eliminated by the kidneys, are retained in the tissues.

That of course is true, but only partly so. Some of the substances accumulated in the organism are, of course, the same as they appear after elimination in the urine, but there may also be some substances that are transformed by normally working kidneys before elimination. When the function of the kidney deviates from the normal, these substances remain unchanged and are probably of a nature that cannot be eliminated by the kidneys.

I mention all this not without purpose. There may also be other cases; there may be cases where toxicity of the urine is increased, where peculiar toxins are detected in the urine, but our attempts to reproduce the disease with those toxins meet with complete failure. And that is the case in a good many infectious diseases where peculiar alkaloids were detected in urine, but none of these alkaloids gave a reproduction of the disease.

Are we justified in admitting in such cases that the disease is due to a toxic agent? We are, as the abnormal toxin present in the urine may not be exactly the one present in the tissues, it may be transformed before elimination, but its presence in the urine indicates the presence in the organism of morbid products though of another nature than the ones detected in the urine.

I may mention here one fact which ought to be of great interest to students of mental and nervous disease. If so far all the attempts to reproduce a disease by the alkaloids or other toxins eliminated by the organism as products of normal disassimilation of tissues, or by the toxins eliminated only in morbid conditions, have been unsuccessful, it was, nevertheless, established that all the toxins mentioned attack the nervous system and that the symptoms they produce are all nervous symptoms. And, therefore, if some may yet doubt that all the symptoms of a certain disease are due to intoxications, it is almost beyond doubt that the nervous symptoms accompanying

the other general disease are the result of abnormal products of disassimilation circulating in the organism.

And another justified conjecture is that in the diseases where the other organs are apparently sound, where no organic changes can be detected even in the nervous system, and where all the symptoms are of nervous origin, that in such diseases the causes of all the symptoms are some substances of morbid disassimilation circulating in the organism.

And so we have to admit that the auto-intoxication may be the cause of certain diseases even if we fail to find a chemical substance capable of reproducing all the symptoms of the disease, and that this supposition is based chiefly on the explanation of the nervous symptoms in general diseases, and of the entire symptom-complex of many nervous diseases.

We may now proceed to discuss the methods for detecting the presence in the tissues of abnormal products (in quantity or quality) of disassimilation, or any other auto-toxines.

We said that the method was first given by Bouchard. He proved that the normal urine possesses a certain toxicity. He proved that every kilogr. of human organism is manufacturing in twenty-four hours toxic material enough to kill four hundred and sixty-four gr. of test animal. This is called the urotoxic coefficient. It is determined by finding out first the amount of urine (numbers of c.c.) necessary to inject for each kilogr. of a rabbit into its blood in order to cause death. Knowing further the total amount of urine eliminated by the individual in twenty-four hours, and the weight of the organism, it is easy to figure out the coefficient. Deviations from this coefficient in one direction or another show either that some normal toxic substances are detained in the organism or that more toxic substances are eliminated than normally.

However, it is not sufficient to take only a single portion of urine at any time of the day to infer from it the

total amount of toxic substances formed in the organism. In such cases two different samples may prove of different toxicity simply on account of different sp. gr. of the urine, and this again might depend on different conditions under which the urine has been eliminated, as, for instance, the quantity of fluid previously consumed. And so the first requisite, in order to judge of the amount of the toxine eliminated by the organs, is to collect the whole urine for twenty-four hours.

But does the urotoxic coefficient in itself, not considering other conditions, indicate the amount of toxic substance left behind the barrier of the kidneys in the tissues? To answer that question we must evidently first consider to what the toxicity of the urine is due. Bouchard found different substances of an organic and inorganic nature, seven in number, with different toxic properties, in some even with antagonistic properties.

All the substances separated by Bouchard are products of normal disassimilation of tissues. But the animal metamorphosis might be diminished in the simple case of diminished ingestion of food. We shall, therefore, find less "urotoxics," as Bouchard calls them, in the cases where the patient is consuming less food than a normal individual, no matter whether he is doing so through the nature of his disease or for other reasons.

And if we still intend to find the influence of the morbid process on the urotoxicity, we have to compare the results not with the normal urotoxic coefficient but with the coefficient of a normal individual consuming the same amount of food.

And not only the quantity of food has to be taken in consideration but also the chemical nature of it. One food may be richer than another in inorganic substances, let us say potassium salts, and the urine of course will eliminate more K salts and, therefore, be increased in its toxicity. It is, of course, understood that the food might contain some toxic substances, and those being eliminated by the urine will increase its toxicity. Or a patient may be

taking some drugs that are eliminated by the urine and thus change its toxicity.

Thus the first condition considered in explanation of the results of the determination of the urotoxic coefficient, is the nature and quantity of the food ingested.

Further, we saw that the toxicity of the urine depends upon a sum of substances—and every substance, after the determination of Bouchard, possesses a different degree of toxicity. We can, therefore, easily understand that the total toxicity might remain unchanged while the relation between different constituents might be very unusual. Let us take a crude example. According to Bouchard, the proportional toxicity of the mineral substances of the urine is $\frac{264}{181}$ and of the organic substance $\frac{127}{181}$. Or, to express in round figures, the relation between the toxicity of the mineral and organic substances is about 5 to 4. It is not improbable that cases may be found where the amount of mineral substances is increased and that of the organic diminished, let us say, in proportion of 7 to 2, the total toxicity remaining the normal. In such a case we, of course, may presume an accumulation of products of metabolism in the organism, as it is clear that the increased amount of mineral salts in the urine would indicate an increased disintegration of the tissues of the organism. The subnormal amount of organic matter in the urine would indicate the retention in the organism of the organic rest of disassimilation of tissues, and we may under such conditions infer the presence of auto-intoxication even if the urotoxic coefficient remains normal, and *vice versa*.

But why then determine the urotoxic coefficient at all? Why not simply determine the proportions of the different constituents? We actually could do so if the chemical nature of all the substances in the urine were known. Unfortunately they are not, and we have to recur to the physiological experiment. And as, on the other hand, the same physiological effect might be obtained under different conditions, we have as much as possible to aid the explanation of the result of the physiological experiment by chemical analysis.

The latter is important in order to understand the morbid process causing the accumulation or hyperproduction of toxic substances in the organism.

What takes place may be only a higher decomposition of tissues, *i. e.*, a simple increase of the combustion, and in that case we would expect to find a higher sp. gr. and a higher percentage of the normal constituents of the urine; or, on the other hand, the morbid process may consist of some deviation of the normal metamorphosis of tissues. For instance, the combustion will not go so far as to form the final product of disassimilation urea, and in such case we will find the amount of the intermediate N-containing substances increased. Or there may appear some N-free organic substances normally absent. They may be of a chemical nature known to us as glucose, aceton, fatty acids, etc., or of a nature at present unknown. In all such cases we are likely to find an abnormal relation between the N-containing and the N-free organic substances. I repeat once more that if the chemical nature of all the organic substances and mainly the substances appearing in morbid condition were known, if we had satisfactory chemical methods for their detection, we would simply have to make a complete analysis of the urine to have a sufficient explanation of the character of the morbid process.

But for the present we have to recur to testing first the urotoxic coefficient, and, in order to understand more clearly the cause of a certain coefficient, to make at least the following chemical determinations:

I.—The relation between organic and inorganic substances;

II.—Analysis of organic substances:

1. Amount of volatile and involatile substances;
2. Amount of N-free and N-containing substances;
3. Analysis of N-containing substances:
 - a.* N- as urea;
 - b.* N- as intermediate substances;
 - c.* N- as NH_3 .

More detailed chemical analysis will, of course, be of yet greater value. But, without those mentioned, the simple determination of the urotoxic coefficient will have but very little value. Of course the food analysis must never be missed.

There is, however, another point yet which must always be kept in mind when we come to draw conclusions from the results of our chemical and physiological urine analysis.

We must never forget that the character of the urine per cent does not depend only on the composition of the blood, lymph or other tissues, on their morbid or physiological state, but also greatly on the state of the kidneys and the heart. Changes in the blood circulation will always influence in a certain way the secretion of the urine; diseases of the kidneys themselves will do the same. If such conditions accompany some general or nervous disease or occur during it, they will, of course, modify the character of the urine, the amount of urotoxics eliminated will be changed, the amount of toxic substances retained in the organism will be increased; but does it indicate that all the symptoms are due to the last condition? Not at all. We know that in all infectious diseases in the acme of the disease, the kidneys are more or less affected and so is the general circulation, and it was proved by different authors (Bouchard, Roger and Gamm) that the urine is much more toxic during the period of convalescence, than in the acme of the disease. It has also been found that in the disease of the heart in the state of compensation the toxicity of urine is normal, but once the compensation ceases the toxicity of the urine is decreased.

In such cases the decreased toxicity will rather indicate that an aggravation or a complication of the disease took place; that in addition to the original disease the function of the kidney is suppressed and, therefore, some toxic substances are accumulated in the organism.

But if only one sample of urine should be examined, regardless of the period of the disease, and if conclusions should be drawn from such an experiment, they might prove entirely erroneous.

It is not sufficient, therefore, in order to understand the nature of the disease, to examine the urine only of one period of the disease, or to examine the urine without paying attention to the period of the disease. It would be less erroneous to determine the number of urotoxics eliminated during the entire disease, and compare them with the number of urotoxics eliminated by a normal individual under comparatively the same conditions of life consuming the same amount of food. It would also be important to compare the different symptoms accompanying the different stages of toxicity of the urine.

I must, however, remark here that if a single examination of the urotoxicity not accompanied by chemical analysis has but little value for the explanation of the disease, it may have a certain *prognostic* interest.

We know the suppression of the function of the kidneys is the most unfavorable accident in any disease; we know further that the greatest number of diseases affect also sooner or later the kidneys; it has been further noticed in many diseases that the toxicity of the urine in certain diseases is decreased or increased in the stage of convalescence. If, therefore, we find in a disease that the toxicity of the urine is subnormal, and then notice that the uro-toxicity is beginning to increase, we can make a favorable prognosis.

On the other hand, if the disease is usually passing with a hypernormal urotoxicity, the decrease of the latter will again give ground for a favorable prognosis.

It has been lately stated that the urine is less toxic in cases of mania and hypertoxic in cases of melancholia. If that should prove true, the changes of the urotoxicity during the disease may have a considerable prognostic value.

There is one more point that is always to be considered in explanation of the results of the urotoxic determination.

We have mentioned already that a subnormal toxicity of the urine may be due not only to accumulation of pro-

ducts of normal metabolism in the tissues of the body, but also to a suppressed metabolism.

On the other hand, if the process of combustion is increased and the kidneys are still normal, they will eliminate all the products of disassimilation and the tissues of the body will not contain more of those products than in a normal state. But there may come another stage of the disease when the kidneys fail to eliminate all the toxic substances manufactured by the organism; the last will, therefore, be accumulated in the tissues of the body and the urine will still be hypertoxic.

As an instance I may mention diabetes. There may be cases of glycosuria with a normal percentage of sugar in the blood and other tissues, as it was more than once found by Seegan, and there may be cases of glycosuria with a very high percentage of sugar in the blood. The urine analysis alone cannot decide the question. The same may be the case with other products of the normal or morbid metabolism, and still it may be of great value, prognostic as well as theoretical, to know the composition of the blood.

I find it, therefore, very important to accompany the testing of the urine with testing the blood serum. But, wherever it is possible, blood can be obtained in too small quantities for a satisfactory chemical analysis, and we have again to limit ourselves to the determination of its toxicity. I should prefer, however, to calculate the toxicity of the serum, not in volume, but in weight.

I wish again to add that more detailed chemical analysis, as the determination of the alkalinity, the determination of the amount of CO_2 , of the relation between the organic and inorganic substances, between the proteids and extractive substances, will all indicate more closely the cause of the morbid toxicity of the serum when this occurs.

SUMMARY.

To sum up my suggestions for work on the question of the urotoxicity, I would say that for theoretical purposes I find it necessary to accompany the determina-

tion of the urotoxic coefficient with the following chemical analysis:

(A) I. The relation between organic and inorganic substances.

II. Analysis of organic substances.

(1) Amount of volatile and non-volatile substances.

(2) Amount of N-free and N-containing substances.

(3) Analysis of N-containing substances:

(a) N as urea;

(b) N as intermediate products;

(c) N as NH_3 .

I should also suggest to inject the urine for the determination of urotoxicity heated to the Te. of 36.5°C. (97.6°F.), as the cold urine may have undesirable influence on the tonus of the blood vessel and the blood circulation. I should also suggest, to collect, if possible, the urine in sterilized bottles, having for each emission a separate bottle.

(B) Further, I find it necessary to have a chemical analysis of the food within the same limits at least as the urine, or experiment on sound individuals of the same weight with exactly the same food as the patients.

(C) The determination of the urotoxicity and chemical analysis for the whole period of the disease.

(D) Where possible, the analysis of the blood serum within the limits mentioned.

For prognostic purposes it may be sufficient to determine only the urotoxicity.

In conclusion I wish to add that I am conscious how insufficient even such determinations are and that endeavors to improve the methods of detecting the toxic substances of urine, the explanations of their origins in the body, and their physiological action are of great importance.

ON SUNSTROKE.
CLINICO-CHEMICAL INVESTIGATION.
(PRELIMINARY COMMUNICATION).

BY P. A. LEVENE, M. D.,
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Although the literature on sunstroke is very extensive and the theories of its nature are very numerous, it can hardly be said that the causes of the various symptoms of that disease are clear even now.

In a disease of so acute a character as this, with symptoms of such eminent danger, the physician has but rarely the time or opportunity to resort to a thorough chemico-clinical examination, and it is, therefore, but natural that the literature on the subject is very deficient on that side of the question.

And yet such study would be of great importance not only for the reason that it would contribute to the better understanding of all the symptoms of the disease, but also to the solution of a number of other problems that are of interest to every pathologist, especially the question of fever.

We know that the temperature of the body rises during the attack of sunstroke to a very high degree without any infection, and it is very important to investigate the relation between this extraordinarily high temperature of the body and the chemical process taking place in the organism.

Does high temperature increase the metabolism, or does it affect the latter in any way?

Further, if it does affect the metabolism, if the final products eliminated by the urine are abnormal in nature or only in quantity, it is interesting to compare them with those eliminated in fever, so as to ascertain what in the latter is due to the influence of high temperature, and what to the special microbial toxins causing the fever.

But our main aim, of course, is to find out the nature of

the sunstroke, and the causes of its different symptoms, and on that basis to devise one or another method of treatment.

The numerous cases of sunstroke during the "hot spell" of the summer of 1896 in New York offered a good opportunity for studying some of the problems mentioned. Unfortunately, the chemical laboratory of the Pathological Institute was not fully equipped at the time of the heat and the "spell" was of such short duration that all the problems mentioned could not be treated in a thorough-going and decisive manner.

The results that we obtained under the circumstances, if they do not yet solve the question of the nature of sunstroke and the problems connected with it, still throw some light on it.

But, to afford a better understanding of the results of chemical and experimental investigation, I will attempt, first, to sum up the chemical condition of the urine in other cases where the temperature of the animal body is increased,—in fever.

It has been long noted that proteid decomposition or N elimination was increased during fever. But as to the explanation of the phenomenon, the relation between the high proteid decomposition and high temperature of the body during fever—the opinions vary considerably.

A good many authorities, and Liebermeister among them, regard this hyperdecomposition of N as a sign of higher oxidation in the organism and therefore as the cause of the high temperature of the fever—they see the cause of the fever in hyperproduction of the animal heat.

On the other hand, the researches of many other authors did not reveal any relation between the degree of the temperature of the fever and the N elimination.

Further, in cases of malaria where the temperature had been lowered by means of quinine the N elimination still remained hypernormal.

Of great importance, of course, are the direct estimations of the oxidation processes by means of measuring

the amounts consumed of O_2 and eliminated CO_2 , and the direct calorimetric determinations on animals.

The results of all the experiments in that direction vary considerably. Many authorities, and Senator among them, found that the amount of eliminated CO_2 *in stadio incrementi* not only does not exceed the normal, but is rather below it. On the other hand, the experiments of Louewy on individuals suffering from tuberculosis, and the fever of which had been caused by tuberculine, show rather an increase of the eliminated CO_2 .

The calorimetric estimations of Gottlieb and Rosenthal show that the heat irradiation in experimental fever is decreased, and that that decrease is responsible for the high temperature of the animal body during fever. In other words, they do not attribute the high temperature to hypernormal consummation of animal tissues. And in corroboration of their opinion the adherents to that theory quote the numerous researches on continuous fever, or investigations of individuals *in stadio fastigii*, where the amount of consumed O_2 and eliminated CO_2 has not been increased notwithstanding the long duration of the high temperature and where the calorimetric determinations could always find a decreased irradiation heat.

We will probably be nearest to the truth in assuming that the high temperature in fever is influenced by both of the causes mentioned.

That the decreased irradiation in itself cannot be responsible for it, can easily be proved by the cases where the temperature rises from 1 to $1\frac{1}{2}^\circ$ C. in a half hour, while under normal heat production, if the irradiation should stop entirely, the temperature of the body cannot increase more than $1\frac{1}{2}^\circ$ C. in an hour.

The question then arises: What is the cause of the high N elimination?

Two theories have been advanced for this explanation: One, that the increase in N elimination is due to the microbial toxine circulating in the organism; and the other, that the high temperature is the cause of the unusual proteid decomposition.

In corroboration of the latter theory, Finkler demonstrated that guinea-pigs with a temperature artificially raised 1° , increase their tissue consummation 3.3 per cent. On other animals or individuals the experiment has not been repeated. It is, therefore, of great importance to investigate the elimination of individuals where the temperature is considerably raised without infection and during normal physical exercise, and such opportunity is offered by the cases of sunstroke.

If the eliminated products of proteid decomposition are here the same in quantity and quality as in cases of fever, the high N elimination in fever can only be due to the high temperature itself. If, on the other hand, the results should be different, the toxines have to be recognized as playing the most important part in influencing the unusual proteid decomposition in fever.

As to the symptoms in sunstroke, all the authors sought to explain them either by asphyxia, or uræmia, although its causes are explained by different authors in different ways.

Some attribute to the heat a direct action on the heart and diaphragm. The rigidity of the heart muscle affects the blood circulation and the rigidity of the diaphragm prevents the normal reparation,—the result of both of them combined is asphyxia (Vallin).

Other authors see the cause of the asphyxia in vasomotor disturbances. It is, in their opinion, originally a direct local irritation of the skin resulting in an angio paresis due to fatigue of the vaso-constrictor nerves. The angio paresis in its turn retards the blood circulation, the supply of O_2 decreases, CO_2 accumulates in the organism, and asphyxia takes place (M. Breitung).

Further, there are also attempts to ascribe the most important influence to the preliminary high perspiration with the following fall of blood pressure (Maas).

Meyer thinks that the heat produces paralysis of the heart which again, in its turn, affects the kidneys and

that the disturbance of the function of the kidneys is consequently responsible for the symptoms of sunstroke.

Reviewing all the theories, we have to remark that they are all mere hypotheses, that every one of the authors is justified in refuting the theory of the other, that none of the authors offers any experimental proof of his theory.

There is only one thing, however, worthy of note. The symptoms of asphyxia as well as the symptoms of uræmia are by more recent researches explained as resulting from toxic substances accumulated in the organism and affecting the nervous system.

The object of the work planned by the Pathological Institute during the past summer was to ascertain whether there actually was any reason to ascribe the symptoms of insolation to auto-intoxication, and, if so, whether the urinary or respiratory organs were responsible for it, or whether an entirely different process was taking place in the organism affected with sunstroke.

The work we did in order to approach these questions can be divided in two parts. In the first place, we examined chemically the urine of individuals suffering from sunstroke, and then injected urine or blood-serum of such individuals into rabbits.

The following tables give the result of the chemical analysis:

TABLE I.

No. 1.—Tom D—e. Patient of Bellevue Hospital. August 10, 1896, received 300 c.c. of urine, specific gravity 1007, reaction acid, proteid present, sugar absent.

Total amount of N 0.495%, N as urea 0.392% = 79.2% of the total.

The patient subsequently died.

No. 2—K—y. Patient of Bellevue Hospital. On August 11, 65 c.c. of urine obtained by means of a catheter, specific gravity 1020, reaction acid, proteids and sugar absent.

Total amount of N 0.896%, N as urea, 0.812% = 90.6% of the total.

Subsequent history of the case unknown.

No. 3.—Carl M—r. Patient of Bellevue Hospital. On August 12, 75 c.c. of urine obtained by a catheter, specific gravity, 1006, reaction acid, proteids and sugar absent.

Total amount of N 0.360%, N as urea 0.308% = 84.5% of the total.
Patient died.

No. 4.—K—g. Patient of Bellevue Hospital, On August 12 received 60 c.c. of urine, specific gravity 1000, reaction acid, proteids absent.

Total amount of N —, N as urea 2.576%.
Subsequent history of the case unknown.

No. 5.—M—an. Patient of St. Vincent's Hospital. On August 12, 28 hours after the attack, received 250 c.c. of urine, specific gravity 1011, reaction acid, traces of proteids.

Total amount of N 0.80%, N as urea 0.73% = 91% of the total.
Patient recovered.

No. 6.—M—an. Patient of St. Vincent's Hospital. On August 12, 55 hours after the attack, received 120 c.c. of urine, specific gravity 1015, reaction acid, no albumen.

Total amount of N 1.81%, N as urea 1.288% = 71% of the total.

Reviewing our cases, the first thing that attracts our attention is the small quantity of urine. Some individuals do not urinate for more than 24 hours after the attack, and if the urine is drawn by means of a catheter it is much smaller in quantity than under normal conditions. Of course, it may be remarked that during the attack patients do not introduce into the organism any water by way of food or drink. But the quantities in our cases are much smaller than in cases of complete inanition, and consequently the latter alone cannot be responsible for the decrease of the water eliminated.

The other striking fact is that, notwithstanding the very small volume, the sp. gr. of the urine is rather subnormal, being in some cases only 1000 or 1006. This indicates that some retention of the solid substances of the urine takes place. Further, we see that out of our six cases, in two only, proteids were present in the urine, and, of course, it cannot be surmised whether the kidneys were affected previous to the attack of sunstroke.

Of great importance for us was, as has been mentioned, to trace the character of the proteid decomposition in our cases. We must remark here, however, that in order to obtain more definite results on the question, the experi-

ments should have been extended for a longer time. The urine and N-containing products might have been retained in the organism during the attack and could have been eliminated during convalescence.

Unfortunately, some of the patients did not survive the attack, and in other cases the attending physicians and the rest of the staff of the hospital were so pre-occupied with other sunstroke patients that they could not pay any attention to the urine of those recovering.

But, not only the absolute amount of the eliminated N decreased, which is due only to the depressed secretion of urine, but also the relative amount in the eliminated urine is in most cases subnormal (less than 1.9 per cent). And only in two cases out of six (Cases Nos. 4 and 6) is the percentage normal. The fact is very interesting that in the last case the urine was obtained fifty-five hours after the attack, when the patient was already convalescent.

Thus our investigations so far justify the assumption that the high temperature during the attack of sunstroke is not accompanied by a decreased metabolism.

Further, the results of the examinations of the character of the N eliminated in our cases vary considerably: In cases 1 and 6 the part of the total N eliminated in the form of urea is below the normal, in cases 2 and 5 the percentage of N as urea is above the normal.

However, upon an analysis of our cases, we find that No. 1 eliminated a considerable quantity of albumen, a fact that justifies our assumption that the patient suffered from Bright's disease in which case the retention of urea in the organism occurs very frequently.

On the other hand, in case No. 6 the urine was obtained fifty-five hours after the attack, and if the amount of N, as intermediate products of decomposition, was higher than ordinarily, it may be explained by the fact that the same products, having been detained hypernormally during the attack (as seen in cases 2 and 5), were eliminated in a greater quantity after the attack was over.

These chemical examinations are very interesting when

compared with the physiological experiments on the intoxication of the urine.

We find that the absolute amount of products of decomposition eliminated is below the normal and that the relative amount of substances with higher toxic power eliminated is also subnormal and are consequently led to expect a decreased toxicity of the urine during the attack and increased toxicity in the period of convalescence.

With a view to investigating this question we performed the following five experiments:

TABLE II.

No. 1.—Rabbit 570 gr. Temp. *in recto* 104, 75 c.c. of urine obtained the same day from patient No. 1, (Tom D—e), were injected partly in the ear vein, partly hypodermically. Within an hour after the injection the animal did not develop any abnormal symptoms. On the next morning it was found dead.

No. 2.—Rabbit 600 gr. 4 o'clock P. M., 35 c.c. of the urine of the patient No. 3, (Carl M—r), were injected into the ear vein. After the end of the experiment the ear seemed somewhat oedematous. Within an hour after the injection, the animal did not develop any pathological symptoms. Till 2 o'clock on the following morning it was found well. At 9 o'clock on the same morning the animal was found dead.

No. 3.—Rabbit 1000 gr. About 25 c.c. of the urine obtained from patient R—rg, (reconvalescent), were gradually injected through the ear vein, when the animal became sick. Soon after it had clonic convulsions followed by tonic ones and the animal died.

No. 4.—Rabbit 1190 gr. The same urine was gradually injected through the ear vein by means of a burette. The animal became sick after it had received 25 c.c. Clonic and tonic convulsions. Death.

No. 5.—Rabbit 1000 gr. The urine was obtained from patient L—within five hours after admission; 25 c.c. of this urine were injected into the ear vein when the heart and respiration became very slow. Clonic and tonic convulsions. Death.

Reviewing these experiments, we find that the urine of the reconvalescent patient R was of higher toxicity than the urine of the patients 1 and 3 and that in the last two cases the toxicity was rather subnormal.

There remained to solve, the question whether the small amount (absolute and relative) of toxic substances

eliminated by the urine was due to the retention of those substances in the body or simply to their decreased production by the organism.

We thought of approaching the solution of the question by examining the toxicity of the blood serum of the patients affected with sunstroke and comparing it with the toxicity of normal human blood serum.

Here are the results of our experiments :

TABLE III.

No. 1.—Rabbit 580 gr. Temp. before the experiment 100.5. At 2.30 P. M. 2.5 c.c. of blood serum of patient F—n were injected into the ear vein; at 3.15 P. M. temp. 101; at 4.45 P. M. temp. 101.8; at 6.35 P. M. temp. 100.6; at 10.35 P. M. temp. 100.

The animal was well.

No. 2.—Rabbit 495 gr. Temp. before the experiment 100° F. At 2.50 P. M. 5 c.c. of the same serum injected gradually into the ear vein; at 3.07 P. M. temp. 101.6; at 3.20 P. M. temp. 102; at 3.43 P. M. temp. 102.2; at 4 P. M. temp. 102.3.

At 4.25 the animal got clonic convulsions followed by tonic ones, and soon died.

No. 3.—Rabbit 435 gr. Temp. before experiment 103.2. At 3.28 and 3.35 P. M. 5 c.c. of the same serum injected into the ear vein; at 3.45 P. M. temp. 103; at 4.05 P. M. temp. 102.6; at 4.30 temp. 103.6; pulse considerably increased in its rate; at 5 P. M. temp. 104.2; at 5.29 the animal got clonic and tonic convulsions and died.

No. 4.—Rabbit 595 gr. Temp. before experiment 103.6. At 11 P. M. 7 c.c. of blood serum of another patient were injected into the ear vein; at 11.20 P. M. temp. 104.2; pulse very rapid, the animal somewhat dull. At 12 midnight, pupil dilated, convulsions clonic and tonic, lasted about one minute and animal died.

(Present Drs. Van Gieson, Meyerowitz and Levene).

No. 5.—Rabbit 1030 gr. Temp. before injection 103. At 11.30 P. M. 10 c.c. of serum No. 2 injected into the ear vein.

Five minutes later the animal had convulsions and died.

No. 6.—Rabbit 1400 gr. Temp. before injection 102.4. At 11.50 P. M. 5 c.c. of serum No. 2 were injected.

The animal did not develop any pathological symptoms.

No. 7.—Rabbit 1220 gr. Temp. before injection 103.4. 4 c.c. of the serum injected in the same way without any effect on the animal.

No. 8.—Rabbit 1550 gr. Temp. before injection 103.4. 45 c.c. of serum No. 2 injected without any effect on the animal.

No. 9.—Rabbit 1400 gr. Temp. before injection 102.4. At 1.05 A. M. 17 c.c. of serum No. 2 were injected hypodermically without any effect.

Our experiments show that 10 c.c. of the blood serum of a patient suffering from sunstroke are sufficient to kill one kilo of rabbit.

We know, of course, that blood serum of an animal of a higher species is considerably toxic to an animal of a lower species, when injected into the blood. But the toxicity for instance, of dog serum to a rabbit, or of horse serum to a dog is much less than in our cases.

On the other hand, the symptoms preceding death from normal serum, as described by Bouchard, are different from those observed in our cases: there were contraction of the pupils and restlessness in the cases of Bouchard, dullness and dilatation of the pupils in our cases.

Of course we shall be able to judge better about the toxicity of normal serum.

But as my work was interrupted by my illness before I could complete it, and as I am uncertain when I shall be able to resume it, I publish these results, considering them only preliminary to a more detailed work and more numerous experiments.

But, scarce as our experiments are so far, they still justify us, I believe, in drawing the following conclusions:

First.—That the high temperature in sunstroke is not accompanied by higher N elimination—in other words, by higher metabolism.

Second.—Consequently, the increased N elimination in fever can hardly be a secondary phenomenon caused by the higher temperature of the organism.

Third.—That the symptoms of sunstroke are, very likely, due to auto-intoxication of the organism, and that neither the kidneys nor asphyxia are responsible for auto-intoxication. As we know, the urea elimination in cases of nephritis is rather decreased, while in our cases it was increased.

Further, in the animal experiments with acute asphyxia, the metabolism is hypernormal and rather the contrary is the case in sunstroke. Thus, a pathological tissue decomposition different from that in any other disease, and causing the auto-intoxication, takes place in sunstroke.

It is not impossible that the heat directly affects the skin, and that the disturbed function of the latter is the primary cause of the accumulation in the organism of substances which are normally being transformed by the skin. Those substances may be the cause of the auto-intoxication and probably they produce secondarily the paresis of the secretory glands, if I may use that expression.

It would also be interesting to examine the density (spec. gr.) of the blood serum during sunstroke, as it was suggested that the preceding high perspiration, with the following condensation of the blood, is the primary cause of sunstroke.

ON THE USE AND PROPERTIES OF A NEW FIXING FLUID (CHROME-OXALIC).

WITH PRELIMINARY NOTES UPON THE FIBRILLAR STRUCTURE
OF THE GANGLION CELLS AND INTRODUCTORY REMARKS
UPON THE METHODS OF FIXATION IN GENERAL.

BY ARNOLD GRAF, PH. D.,

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The so-called fixing methods of the cytological technique are very numerous, but as we are, as yet, unable to establish a theory of the action of the different fixing-fluids upon organisms, owing to the obscurity in which the chemical processes taking place within the cells,—both as normal life phenomena and as reactions to abnormal stimuli—are hidden, we are very far from obtaining certain and unvaried results by the fixation of tissues.

It may be said in the beginning that the term “fixation” is in its present use exceedingly vague, and includes such widely different processes as killing, preserving, sterilizing, hardening (by formation of insoluble compounds) and dehydrating. Naturally in most cases several of these reactions result together from the use of one “fixing fluid.”

The end-result to be obtained by these preparatory processes is to preserve the structure of the tissue or cell in question as perfectly as possible, entirely disregarding its chemical constitution. In cases where whole organs or whole animals are to be preserved, it is important to effect an even preservation throughout the piece, which is only very rarely the case.

There are preserving fluids of different character in use, which may be roughly classified in the following way:*

1.—Fluids which rapidly kill the finer structures of the

* This classification must not be regarded as a definite one, but I suggest it here for convenience's sake. I expect that when the second volume of Apathy's excellent work “Die Microtechnic der thierischen Morphologie” appears it will contain a rational and thorough classification of the fixing fluids according to their chemical action, as far as this is known.

organic body and leave their natural shape more or less unaltered. The cause of the killing is as yet entirely obscure.

The alteration in shape may be due to a swelling or to a slight shrinkage. Swelling is in this case due to an imbibition of water on the part of the semi-fluid substances, and shrinkage may be due to a momentary reactive contraction of these semi-fluid substances in the instant of death.*

Such fluids are: Nitric, acetic, oxalic, sulphuric and other acids, which cause a partial swelling. Chromic acid causes in many cases shrinkage, probably due to its reduction and the formation of chromic salts in the pericellular spaces.

It is probable that by the use of acids for fixation no insoluble salts are precipitated in the cytoplasm, to which we ascribe an alkaline reaction, whereas in the nucleus (the most important substance of which is nucleic acid) more solid compounds are formed by some substitution in the nucleins. This is made probable by the fact that after the fixation of cells with acids strongly refringent structures appear in the nucleus which were till then invisible.

2.—Fluids which rapidly kill the living matter upon contact with it, but which do not preserve its structure.

These fluids, to which must be reckoned all the bases, the carbonates of the alkalimetals, etc., dissolve very rapidly a great part of the semi-fluid substances in the protoplasm, and, if left long enough in these true macerating fluids, the entirety of the cells is destroyed structurally by dissolution.

Basic reagents ought therefore to be carefully avoided in the preparation of specimens.

3.—Fluids which have originally an anæsthetic effect upon the organism, but which gradually kill it, if applied

* The organisms are composed of living matter or protoplasm (better bioplasma) which is probably of a semi-fluid consistence, paraplasma, or protoplasmic lymph which is a watery fluid pervading the protoplasm everywhere, and products of metabolism foreign to protoplasm, which may be solid, gaseous or fluid. It is the first two which interest us here.

long enough, by dehydration. They occasion almost no chemical changes in the structures, but cause intense shrinkage by the too rapid dehydration. To these fluids pertain all the lesser alcohols. They act at the same time as killing and hardening fluids.

4.—Fluids which form solid compounds with the semi-fluid structures of the protoplasma and render these structures rigid and brittle. Among these fluids we find many of the most popular fixing fluids as mercuric-bichloride, osmic acid, chromic acid, and in a degree also picric acid, and the different mixtures made from these and also combinations between them and other acids or salts.

5.—Salt solutions of the heavy metals which are reduced within the cells by appropriate treatment. These fluids are known as impregnation fluids and the methods in which they are used are called impregnation methods. Such are the Golgi group and the gold-chloride methods.

6.—Fluids which keep the semi-fluid structures in the cells in a very slightly hardened but still semi-fluid state, and which form with the dissolved salts, albumines, etc., in the tissues such compounds as may easily be washed out and replaced by water and the graded alcohols.

Among this last group, I reckon Perenye's fluid and the new fluid chrome-oxalic. Perenye's fluid is made up of four volumes of a 10 per cent solution of nitric acid, three volumes of absolute alcohol, and three volumes of a 0.5 per cent solution of chromic acid.

This fluid has the property of preserving the shape of the animals* or organs immersed in it almost perfectly, but it occasions considerable swelling within the cells, which is probably due to the noxious action of the nitric acid. It is a property of most of the salts of nitric acid to be highly explosive and it is possible that the nitrates formed in the protoplasm by its immersion in Perenye's fluid are partly exploded by the action of the free oxygen which is produced by the reduction of the rest of the

*Of course only very small animals, invertebrates and small fishes or embryos of higher vertebrates.

chromic acid in the fluid to chromsesquioxide, which reduction may be instigated by substances in the cells themselves. Such slight explosions would result in a loosening of the structures in which they take place, and we might therefore attribute the swelling of the tissues to that cause.

I formed years ago the resolution of substituting some other acid instead of the nitric acid in Perenye's fluid, but I never could find the amount of time necessary for the execution of such experiments until the summer of 1896 when I worked in the Marine Biological Laboratory in Wood's Holl, Mass.

I substituted a variety of acids instead of nitric acid, and in order to secure more complete preservation I increased the proportion of the chromic acid from 0.5 per cent to 1 per cent, thus giving the ensuing oxidations more fuel, as one might say.

The first acid which I substituted was by a mere chance oxalic acid $C_2O_4H_2$, and strange to say, it proved until now to have been the only valuable combination. The first formula which I used was:

- 4 vol. oxalic acid 10 per cent.
- 3 vol. alcohol 95 per cent.
- 3 vol. chromic acid 1 per cent.

In one instance, I increased the chromic acid to 2 per cent, but discarded the fluid soon as destructive.

During the use of the first formula I noticed a slight swelling in the tissues on account of which I reduced the proportion of the oxalic acid from 10 to 8 per cent. Thus the fluid as I use it now has the formula:

- 4 vol. oxalic acid 8 per cent.
- 3 vol. alcohol 95 per cent.
- 3 vol. chromic acid 1 per cent.

It is important to mix the fluids in the above sequence, as, by mixing the alcohol with the chromic acid first, a total oxidation of the alcohol would take place.

The fluid is of a beautiful Bordeaux-red color, with a greenish blue fluorescence; it is of slightly lower specific gravity than water.

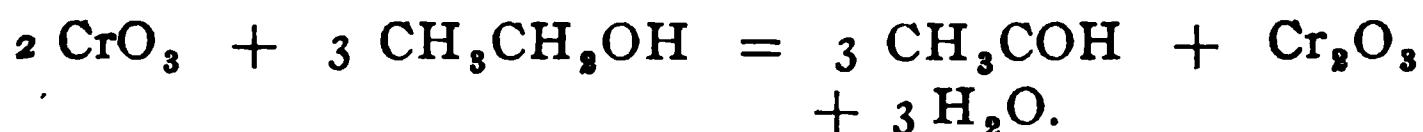
This fluid is not to be regarded as a chemically uniform reagent, but it is a mixture of a great number of different substances.

Among the gases and lighter fluids are: Acetic acid, a little carbondioxide, ethylaldehyd and polymers of the same, and different esters.

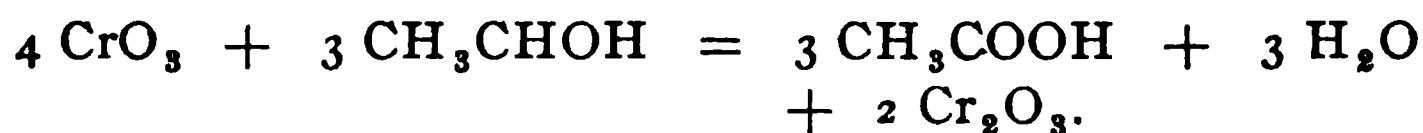
Among the heavier fluids are chromoxalates, chromacetates, and uncombined chromic acid.

The chemical process taking place by mixing the three original substances, oxalic acid $C_2O_4H_2$, alcohol C_2H_5O and chromic acid CrO_3 may be theoretically formulated in the following way:*

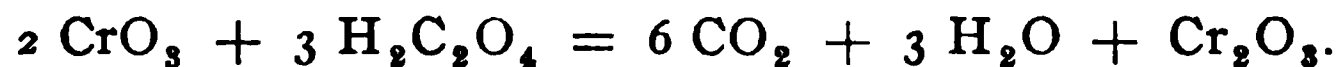
Chromic acid $2 CrO$ may be reduced by the alcohol to Cr_2O_3 and oxygen $3 O$ is liberated, which oxidizes the alcohol to acetic aldehyde,



This acetic aldehyde may be further oxidized to acetic acid, either directly or in the initial reaction as follows:

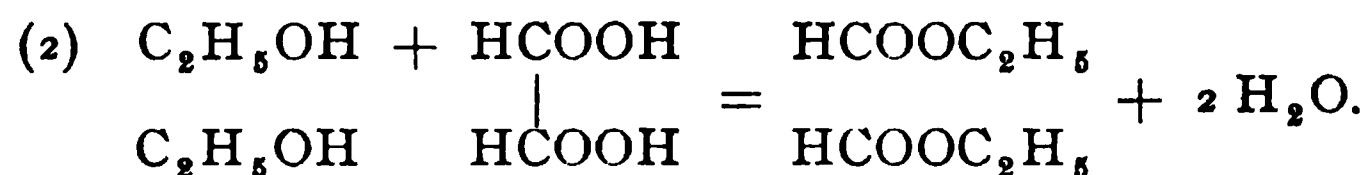
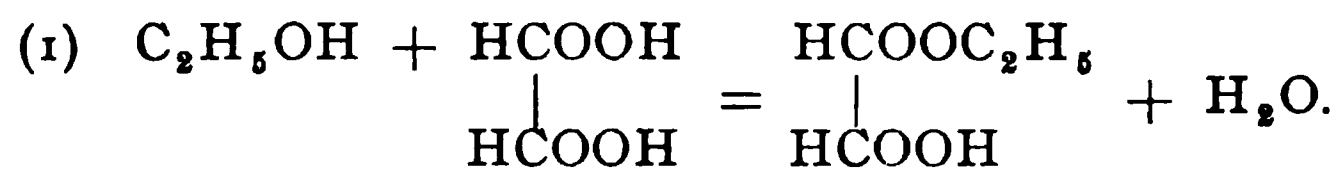


The oxalic acid may be oxidized by the CrO_3 in the following manner:



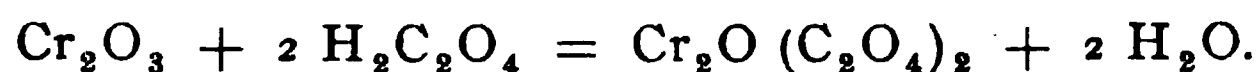
This reaction will, however, not occur in this dilute solution, as I have found no liberation of any consequence of CO_2 to occur.

Alcohol and oxalic acid may form compound esters, the C_2H_5 group of the alcohol replacing the H in the acid radical:



The Cr_2O_3 may combine in various proportions with oxalic acid:

*This is only the simplest theoretical formulation as it would lead much too far to enter into all the *possible* reactions taking place in that case.



One or more of these oxalates may be present in our solution, and besides these we may also have therein contained the various condensation products of carbonic acid, ethyl alcohol and oxalic acid and their various oxidation products (due to the oxidizing action of CrO_3).

I am very much indebted to Doctor S. Bookman for obliging me in formulating these chemical processes, and it is a great pleasure to me to express in this place my best thanks to him.

We have perceived that the fluid "chrome-oxalic" is a very complex mixture of aldehyds, esters, acids and salts. This is, of course, a great drawback inasmuch as it is impossible to tell to what agent the preservation of certain tissues is due, the possible reactions of the different components upon living protoplasm being legion; but the practical advantages are such that I do not hesitate to declare it as the finest preparing fluid for the microscopical investigation of many tissues which I ever have employed, both preventing a destruction of the finest cellular structures and securing a brilliant stain in the sections with a great variety of staining methods.

The results which I obtained by the use of other fixing fluids of the same category as chrome-oxalic, (the only difference being the substitution of other acids instead of the oxalic acid) are of a certain theoretical interest, as they show marked differences in their behavior towards tissues, but it would lead too far to report all of these details at present, the more so as my observations are not yet entirely finished.

It is sufficient to say that I have substituted instead of the oxalic acid the following acids: sulphuric, hydrochloric, chloric, orthophosphoric, metaphosphoric, hypophosphorous, phosphotungstic, phosphomolybdic, formic, acetic, tartaric and citric acid.

I have, moreover, substituted in most of these fluids methylalcohol for ethylalcohol, but thus far I cannot state

any appreciable difference between the preserving action of the ethylic and the methylic series. It is probable that the end products will be similar, whether we take methylic or ethylic alcohol as a starting point.

Thus far I have already obtained for the most part results with a series of 28 fixing fluids, all made up after the same principle, the only difference consisting in the salt and in the free acid rest.

I intend yet to substitute a higher alcohol instead of ethylalcohol and so to obtain a third series, and, if it should prove of interest during the course of the investigation, to replace the chromic acid as an oxidizing agent by potassium permanganate.

The action of these different but principally related fluids upon the structures of the cells and upon the subsequent staining affinities of these cells being carefully recorded and compared, we may obtain valuable items for the theoretical conception of the chemical nature of fixation and possibly of the staining processes.

It will be also necessary to use along with these mentioned fluids, as a sort of control, the supposed components of the fluids in their *pure* state for fixation, as, *e. g.*, the free acids, the chromic salts, aldehydes and esters. The investigation must of course be carried out on a variety of different tissues, and the material must be further treated by the most approved imbedding and staining methods.

In the following I will briefly outline the results thus far obtained with the chrome-oxalic fluid.

RESULTS ON INVERTEBRATES.

The first experiments were made with the leeches *Clepsine bioculata* and *Cl. nepheloidea* which were immersed whole in the fluid.

The stains used were iron-hæmatoxylin (Benda-Heidenhain) and different new modifications of the Biondi-Ehrlich-Heidenhain method, which will be recorded elsewhere. The sections stained with the iron-hæmatoxylin-Bordeaux red showed the following features:

The nuclei were with regard to structure perfect in every kind of cells of the animal, showing especially the linin-network with great clearness. The chromatin-

granules stained blue with a reddish tinge, the nucleoli blue and almost black. The nuclear membrane appeared dull red.

The cytoplasmic network showed to perfection, especially in the nephridial cells and in the smooth muscle cells.

The contractile fibrillar substance of the latter was beautifully differentiated.

The same is true of the ciliary structures on the surface of the intestine cells.

The ganglion cells of these forms are very small, and therefore not well adapted for a comparison with regard to their structure. I will show later on that it is especially in the preparation of the nerve cells that this fluid is superior to all others.

The salivary gland cells showed very interesting features and admitted of a brilliant stain.

I have also preserved the intestine of a big beetle, probably *Hydrophilus*, in this fluid.

The preservation of the intestinal cells was in this case not superior to that obtained by some other fixing fluids, like Lang's fluid or picric acid, and the subsequent stain of the sections looked to me rather unclean and diffuse. I do not know whether I must attribute this failure to a specific unsuitability of this particular specimen or of the fixing fluid used. It seems that the latter is the case, as I have obtained very much nicer preparations by another fluid, chromochloric, which was mixed in the same way as chromoxalic but in which a 5 per cent chloric acid solution was substituted in the place of the 8 per cent oxalic acid.

The voluntary muscles of this animal were, however, very well differentiated and showed some interesting details in the cross-stripes which I trust to describe with illustrations in some other paper, as these structures are of the highest importance in the settling of the microsome problem.

On the whole, the fluid has not proved very successful on this arthropod material, but it would be hasty to dis-

card it even in this case without making more numerous experiments on other different Arthropods.

RESULTS ON VERTEBRATES.

Of vertebrate material I have fixed in chrome-oxalic: 1. Embryos of *Squalius Acanthias*; 2. Different organs of the bull-frog; 3. Normal human tissues, and 4. Cortex and cerebellum of an uræmia case.

With regard to the fixation of the shark embryos I have only to say that it has been excellent. There was no shrinkage or swelling even in the most delicate cells as *e. g.* in the red blood corpuscles. These latter appeared as perfectly round spheres with a small dark nucleus and a very beautiful cytoplasmic network. The nuclei are in all cases especially well differentiated, showing the nucleoli, the chromatin, the linin-network and the nuclear membrane with great clearness and electively stained. Thus the chromatin stained—with my modification of the Biondi-Ehrlich method—dark green, the nucleolus red, the nuclear membrane sometimes red, sometimes green, and the linin-network red.

Of the bull-frog, I have only fixed in chrome-oxalic, the liver, spleen, lung and kidney. The kidney and liver were exceedingly well preserved. In the kidney cells, *e. g.* the fringe which lines the convoluted tubule-cells was in most tubules unbroken and well stained. The nuclei were very beautiful and the linin-network appeared in the characteristic bead-like arrangement which is so very rarely seen even in very well stained sections.

The results which interest us most are naturally those which were obtained in the normal and pathological human material, and it is just here where the great usefulness of the fluid is most conspicuous. I shall report these results organ by organ.

The human tissues were obtained from Case No. 684 of the Pathological Institute. The tissues had been taken out of the body of an electrocuted man fifteen minutes after death and were directly immersed in the fixing-

fluids, by which caution all post-mortem artefacts were absolutely excluded.*

Small pieces of the following organs were preserved in chrome-oxalic: Paracentral lobe of cerebrum, cerebellum, pituitary body, hippocampus, cervical cord, lumbar cord, semilunar ganglion, spinal ganglion, inferior cervical ganglion, sympathetic, anterior spinal nerve-root, retina, suprarenal body, rectus, pyloric stomach, submaxillary gland, kidney, œsophageal stomach, liver, jejunum, pancreas, duodenum and testicle.

The most important results for us are those obtained on the nerve cells.

STRUCTURE OF NERVE CELLS AS SEEN AFTER THE CHROME-OXALIC FIXATION.

The accompanying Figure 1 shows a drawing of a giant cell in the paracentral lobule of the cerebrum.

The section in which it was contained was stained with the iron-hæmatoxylin method and we notice the following particulars.

The nucleus shows a darkly staining membrane and is filled with a fine network of fibres between which the small chromatin-granules are suspended. In the middle of the nucleus lies the very dark nucleolus with a vacuole in its centre.

The cytoplasm shows the most beautiful fibrillar structure that I have ever seen. The fibrillæ are exceedingly fine and are very regularly arranged in the cell processes and on the surface of the cell, whereas they form a more intricate network in the centre of the cell especially around the nucleus. By closer observation of a favorable spot (the best places are the processes where the stain is not very intensive) we notice that these finest cytoplasmic fibrillæ are not smooth, like smooth muscle fibrils for instance, but are composed of a row of minute beads closely arranged in single file.

It takes considerable patience to be able to see these

* In obtaining this case we are much indebted to the appreciation of Mr. O. V. Sage, Warden of Sing Sing Prison, of the valuable scientific investigations which such material furnishes.

marvelous structures in a number of these fibrillæ, owing to their excessive minuteness (about one hundred millions of these granules would occupy the area of a millimetre square), but in some more conspicuously placed fibrillæ they are to be seen without great difficulty. The pen and ink drawing which was used for illustration was copied with the greatest care from an accurately executed pencil drawing of the cell as it appeared to the eye, and there is no exaggeration of any of the details.

The two granular masses (*pig.*) represent the pigment patches which are so often to be found in the adult ganglion cell of the higher vertebrates.

The Nissl bodies or plaques, it is true, have much less affinity for the hæmatoxylin than for the methylene-blue and some other aniline dyes, but yet they stain slightly. We notice that the individual plaques, which in a Nissl specimen appear as dark-blue patches, are by the iron-hæmatoxylin method differentiated as heaps of isolated small granules, and it is interesting to observe how these granular masses are elongated in those places where the fibrillæ are especially parallel to each other. A gradual decrease of granules is noticeable in the individual plaques if we approach towards a protoplasmic process and the process finally is entirely devoid of plaques.

This most beautiful fibrillar structure of the ganglion cell is revealed in its finest details by the chrome-oxalic fixation, a result which is not to be obtained in such perfection by any other fixing fluid. It is of the utmost importance to get, besides the usual Nissl specimens, also such preparations in which this fibrillar structure is plainly visible, as in cases where no pathological changes are noticed in the Nissl bodies, yet morbid changes may be hidden in the cell which only affect the fibrillæ. An irregularity in the transmission of nervous impulses and even a slowness of responding to stimuli may very well be due to an abnormal condition of these fibrillæ which are clearly the paths along which the nervous impulses travel.

The beauty in working with chrome-oxalic lies espe-

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THE FIBRILLAR STRUCTURE OF GANGLION CELLS AS DEMONSTRATED
BY CHROME-OXALIC FIXATION.

FIG. 1. PYRAMIDAL CELL OF PARACENTRAL
LOBULE, NORMAL HUMAN BRAIN

FIG. 2. PURKINJE-CELL OF NORMAL HUMAN
CEREBELLUM

cially in the fact that one may apply after its use a number of different staining methods with equally good results. I have obtained such splendid Nissl stains as with no other method after chrome-oxalic fixation, and the Biondi-Ehrlich modifications, which have been worked out in the course of my experiments applied after chrome-oxalic preservation, secured brilliant and very constant differentiations of the various nuclear substances and of the cytoplasm.

The second picture is taken from a Purkinje-cell of the cerebellum fixed with this fluid, and stained with Biondi-Ehrlich mixture.

We notice in the protoplasmic process the same fibrillar structure as in the pyramid cell processes, but I have not been able to resolve the individual fibrillæ into granules in this case. The fibrillæ run parallel in all the protoplasmic processes even in the finest end-terminations in all of which I have been able to trace them in my sections.

The nucleus shows no great difference from that in the pyramid cell. I shall therefore proceed to the description of the axis-cylinder. By a piece of good luck I have struck in this section a cell which was cut along the median plane and in which the principal protoplasmic process, the axis cylinder and the nucleus were cut through their respective central axes.

The axis-cylinder appears composed of numerous fine fibrillæ which rapidly spread at the entrance into the cell and run peripherally over the surface of the cell, thus forming a basket of fibres, from which surface-network individual fibres are everywhere given off into the cell-body where they mingle with the very intricate central threadwork of the fibrillæ. A glance at the picture will explain the structure better than pages of text. I shall, therefore, go on to describe another very interesting result obtained by the use of that fluid.

It is well known that in Golgi-preparations the finer branches of the Purkinje-cells appear studded with the so-called gemmules, little granules which are attached to the branches of the protoplasmic processes by short threads.

These granules have been repeatedly declared as artefacts produced by the Golgi method, (notwithstanding their regularity and peculiar structure), on account of the impossibility to demonstrate them by any other method.

In examining some slides of normal human cerebellum fixed with chrome-oxalic, one place was found in which a Purkinje-cell was cut so that almost the whole branching system of the protoplasmic processes was contained in one section, and I noticed that all the finer processes of the cell were accompanied in all their bendings by clusters of small granules which evidently must be the gemmules. The difficulty in demonstrating these granules lies in the fact that in a Golgi-section nothing is stained but these gemmules and the cell-processes, whereas in the ordinary methods all the other elements of the molecular layer of the cerebellum are stained at the same time. Thus a great number of cross-sections through nerve fibres not pertaining to the Purkinje-cells appears as granules, and this confuses the picture somewhat. Furthermore, the gemmulæ, as they appear in the Golgi-preparations, are much larger than those in my preparations, an explanation of which is furnished by the consideration that in the Golgi method the cellular structures are not only penetrated by the silver salts, but that also around these structures a surface deposit is precipitated, by the reduction of which the size of the structure is exaggerated.

I believe that I am right in the statement that the gemmulæ of the Purkinje-cells cannot be considered as artefacts produced by the Golgi-method, as soon as we can demonstrate them by an entirely different method, like the chrome-oxalic-iron-hæmatoxylin process.

This discovery may be of some importance in the study of such nervous diseases as those where the gemmulæ are destroyed and cannot be demonstrated by the Golgi-method.

Very important results were obtained with regard to the finer structure of the nuclei of the ganglion cells, which, however, will be reported in another paper.

In the same slides through the cerebellum different

other cellular structures were well differentiated which are usually only demonstrated in Golgi-slides, as *e.g.* the granule-cells with their small protoplasmic body and their T shaped axis-cylinder, the Golgi-cells, the climbing-fibres, the mossy-fibres and different cells of the molecular layer, some of which are probably the basket-cells. Illustrations and detailed descriptions of these structures will be given in another place.

The cells of the Hippocampus show practically the same structures as the smaller pyramid cells and it is unnecessary to describe them separately.

The pituitary body was, like the rest of the tissues, preserved without shrinkage, the cells and nuclei being well differentiated.

Both in the cervical and in the lumbar cord magnificent differentiations of the large anterior horn cells were obtained. The fibrillar nature of the protoplasma was again clearly noticed and the Nissl-bodies showed the following peculiarities. Whereas in the pyramid and in the Purkinje-cells the Nissl-plaques stain with the Nissl and the iron-hæmatoxylin methods only and not with the Biondi-Ehrlich method, I have obtained a green stain of the Nissl plaques of the anterior horn cells with my modification of the Biondi-Ehrlich method.

In these slides the nucleus contained only a few green granules, the great mass of the chromatin was stained red, the nucleolus orange, the cytoplasm pink, and the Nissl plaques green. This shows that there must be a chemical difference between the cellular structures of the different kinds of ganglion cells, a fact which is of very great importance for the theoretical investigation of the nervous processes.

The cells of the semilunar, the spinal and the inferior cervical ganglion showed practically the same structures and may be described together. The most evident advantage of the method is, that it prevents shrinkage or swelling almost absolutely, which is best seen in these cells. In most of the preparations made of spinal ganglion

cells by the usual methods the cell-body is often, to a considerable degree, shrunken away from the capsule of connective tissue cells in which it is enclosed. In my preparations the cells fill the capsule almost entirely and are well stained and differentiated. The plasma of the capsule-cells is striated like that of other fibrillar connective-tissue cells. As we have here a method by which shrinkage is eluded, we are enabled to pronounce cells more securely as diseased, if we meet with shrinkage in cases which were preserved in the same way. (The utmost care in the imbedding and mounting processes is of course always implied). The same advantages apply to the fixation of the sympathetic and the retina.

In the suprarenal body the following differentiations were observed. In the zona glomerulosa the cells presented a beautiful cytoplasmic network of fine fibrillæ with microsomes in their meshes and inclosed no fat globules.

The cells of the zona fascicularis appeared strongly vacuolated, all the vacuoles being about the same size. Between the vacuoles the cytoplasmic threads and the microsomes are clustered together. The vacuoles contain fat, which in this case is dissolved out by the alcohols, etc.

The cells of the zona fascicularis gradually change their aspect in the lower levels until the zona reticulata is reached, in which the contents of the cells are decidedly granular, looking very much like salivary gland cells. These cells contain the pigment and appear darker than the other cells.

The medullary cells show a fine cytoplasmic network of fibres among which microsomes of different sizes and pigment granules are imbedded. These medullary cells resemble somewhat in their structure the liver cells.

The connective tissue membranes and septa are very beautifully differentiated by the stain.

In the rectus the finer structures of the cells are too small to admit a careful examination. The striped appearance of the muscle fibres was, however, very strikingly preserved.

The stomach sections which I have are not at all satisfactory and I do not know to what to attribute the failure of obtaining good preparations. I do not think it is the fault of the fixing-fluid, as I have excellent sections through the duodenum in which the fringe on the surface of the cells is quite perfectly preserved.

The cells of the submaxillary gland showed a fine cytoplasmic network and well differentiated nuclear structures.

The pancreas and jejunum, on the other hand, was not well preserved.

The kidney was either diseased or considerably affected by the electric shock as the convoluted tubules were filled with debris, the cells seemingly broken to pieces in places, and the fringe lining the free surface of the tubule cells was only partly preserved. The collecting tube cells were very much better preserved, showing a fine cytoplasmic network in their cell body. Better than the kidney-cells appeared the liver-cells, which were sharply differentiated from the capillary network, the walls of which were clearly seen.

In the testis finally the karyokynetic figures were very well preserved.

Of pathological material I have preserved in chrome-oxalic a piece of motor cortex and of cerebellum of Case 767 (uræmia) of the Pathological Institute.

The pyramidal cells were intensely shrunken in size and a big pericellular space was conspicuous. The nuclei of these cells stained intensely green in the Biondi-Ehrlich fluid. Two kinds of modified cells were distinguished by this method: 1. Strongly shrunken cells with dark green nucleus and dark red cytoplasm, and 2. Less shrunken cells with yellowish red cytoplasm and great nuclei, with a green membrane, green, rather loose, chromatic network and red nucleoli. This difference was not revealed by the Nissl stain.

In the cerebellum the Purkinje-cells were comparatively little changed; they appeared less brilliantly stained, the

fibrillar structure of the processes was not so pronounced and the nuclei contained more green granules than in the normal cells. By the Nissl method the chromophilic plaques were revealed but not as regularly arranged as in the normal cell, but in small irregular groups scattered through the cell.

I have to conclude from these various observations that the fluid is certainly worthy of introduction into the microscopical technique owing to (1) its rapid penetration; (2) the perfect preservation of the finest cellular structures, and (3) the rarity and brilliancy of stains which are possible after its preparatory use.

The length of time which the tissues have to remain in the fluid to be thoroughly well prepared naturally varies according to the size of the immersed pieces. For small pieces, of 2 to 5 mm. in thickness, I would recommend immersion from one-half to two hours.

The tissues have to be washed shortly in running water and repeatedly in alcohol of 30 per cent and 50 per cent.

The next steps in the treatment are as usual, dehydration in graded alcohols, imbedding in paraffine with great care and staining on the slide.

ON THE THERAPEUTIC VALUE OF BLOOD- LETTING—AN EXPERIMENTAL STUDY.

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The story of bloodletting as a therapeutic measure is almost unparalleled. For, regardless of the changing and often opposing views, in spite of the diverse theoretical notions of the dominant schools, we find the practice of bloodletting prevailing at all periods in the history of medicine and abating only in the second half of our century.

And it is but natural that blood, which permeates the entire human body, and the loss of a certain quantity of which involves death, should have been considered by our forefathers as a fluid of the most vital importance, little as they knew of its anatomical or physiological character. Before Harvey's discovery of the circulation of the blood, it was generally accepted that the composition of blood was different in different parts of the body, and while it was diseased in one place, it might be healthy in all other parts. Therefore, the vessels of the diseased parts were always opened. Since Harvey's discovery, however, it is the most convenient vein which is opened, whatever the seat of the disease. During that long period the indications for it were very extensive, there was hardly any diseased process where it was not applied. Even in the twenties of this century, when the reaction against bloodletting had already set in, the physicians favoring the restriction of its use most, still advocated its application at the following quite extensive indications:

- 1.—As an antiphlogistic in all fevers and inflammatory processes.
- 2.—As a depletory agent in order to lessen the increased amount of blood in the body.
- 3.—As an abstractive in order to remove the bloodstasis or to divert an inflammation from some internal organ.
- 4.—As a nerve sedative and anæsthetic or even narcotic

(operations were rendered painless by previously bleeding the patient until he fainted).

5.—As a prophylactic measure in order to prevent apoplexy or inflammations of the internal organs after excitements. (Krueger)¹.

From these indications of the conservatives, we can securely infer that the adherents of bloodletting hardly recognized any disease in which it could not be applied.

Still the reaction against bloodletting kept on increasing and at a certain period it looked as though this therapeutic measure were going to be forgotten entirely.

But during the last ten or fifteen years, the practice of bloodletting seems to have revived. It is again being recommended in pneumonia (Duplaa de Garat², Moore³), eclampsia (Gucarof⁴), aneurism (Davison⁵), etc. Many advocate the use of bleeding in chlorosis (Wilhelm⁶, Scholz⁷, Schubert-Reinerz⁸.) Not longer than six years ago, Pye-Smith⁹, at the Royal Medical and Surgical Society, felt warranted in promulgating the following indications for bleeding: (1) Cyanosis with distension of the right side of the heart, whether from pulmonary or other obstruction to the circulation. (2) The intense pain of aortic aneurism. (3) Uræmic and prolonged epileptic convulsions. And in the debate that followed he was supported by such prominent authorities as Stephen Mackenzie, Broadbent, J. Hutchinson, G. Humphry and others. Almost as broad indications are given by Albu¹⁰.

Thus it seems that modern medicine again inclines toward that old favorite remedy, but, as in the previous periods, it seems to begin at the wrong end. It might have been pardonable for the empiric physician of former times to apply immediately to his patient whatever his scholastic reasoning dictated to him. Modern medicine based on, and in itself a part of, natural science, requires that every pharmacological or other therapeutic agent undergo a certain test before it can be applied on a human being.

The experimental-physiological test must prove that the

agent does not work injuriously on the organism and that from its effect on the different organs of the animal body it is likely to show beneficial results on a certain pathological process.

The experimental-pharmacological test, in a new and wider application of the word, must prove that it really acts beneficially on the supposed pathological process produced experimentally on animals. And only after that we are justified in testing the remedy at the bedside.

Let us see now whether bloodletting answers all those requirements of modern medicine.

Naturally, it is only in the seventies of this century that we find the first works on the physiological influence of bloodletting on the organism.

Immediately after bloodletting, the quantity of red blood corpuscles and hæmoglobine is decreased (Koeppe¹¹) the sp. gr. of the remaining blood is lowered (Ziegelroth¹²). The temperature of the body is also lowered by bloodletting (Lorain¹³, Choraszewsky¹⁴), but within from a few hours to two days, in proportion to the quantity of the blood extracted, the organism again assumes its former state. The sp. gr. and the temperature even rise above that prior to bloodletting. The metabolism of nitrogen after bloodletting is increased, but the metabolism of fat, on the contrary, even decreases, as also does the gas metabolism (Bauer¹⁵). The pulse, after a slight rise, is decreased by the bloodletting. The number of white corpuscles also seems to increase (Bauer¹⁵).

As to the blood pressure, some assert that bloodletting has hardly any influence on it at all (Worm-Mueller and Lesser¹⁶, Nawrotzky and Gatzuk¹⁷), while others hold that it is also being lessened.

Should we recapitulate all we know of the physiological influence of bloodletting on the animal body, we should find that it may temporarily produce a rather slight deplethoric influence (decreases in blood pressure and pulse).

The other effect of bloodletting, much more manifest,

is the temporary increase of the general metabolism and the increased blood formation.

The normal amount and consistency of blood seems to be an essential condition of life of the animal organism.

Every loss of blood has as its consequence an increase in the work of the blood-forming organs, and subsequently of all other organs of the body, hence the increase of the general metabolism.

Now is there anything in the physiological action of bloodletting to recommend it *a priori* as a therapeutic measure?

The physical deplethoric action of bloodletting is hardly of any avail. The decrease of blood pressure is not established beyond doubt, especially as we know that the blood vessels are so adaptable that they may receive double their ordinary amount of fluid without marked effect (Samuel¹⁸).

The advocates of bloodletting assume that after venesection the lymphatic fluids of the congested parts, owing to the altered condition of pressure, find their way into the blood vessels, thereby lessening the local congestion. But even if we assume that the blood vessels have the property of drawing in the lymphatic fluid, there is no proof that that fluid is being abstracted from the congested parts and not evenly from all parts of the organism.

Modern pathology proves that not all the notions and ideas of the humoral pathologists of former times were absurd. Blood seems to be the most important factor in a great number of pathological processes. Most of the bacterial diseases are produced in one of the following ways: Either the bacteria remain in their place of invasion and produce there different toxins which are subsequently absorbed by, and circulated in, the blood (toxhæmiæ). Or the bacteria themselves penetrate into the blood and injure their host by their metabolism (bacterhæmiæ).

Furthermore, the blood also does the work of defending the organism against the bacterial intoxications, either by

the means of its white corpuscles (Metschnikoff) or by the different chemical substances, alexines developed in its serum (Buchner).

Many other pathological processes, like myxoedema, diabetes, uræmia, eclampsia, and some gastro-intestinal disorders have as their cause intoxication by poisons either produced inside of the organism itself through some disorder in its metabolism or introduced from outside. Most of these poisons also circulate in the blood.

The opinion has been expressed that in most of these processes bloodletting may be beneficial, not only in that it increases the general metabolism, but also that it diminishes the amount of poison circulating in the blood (Albu¹⁰).

I consider this the most satisfactory explanation of the value and necessity of bloodletting, if it has any, and that if bloodletting is of any benefit it is so in these cases of bacterial and other intoxications.

I therefore concluded to test experimentally whether bloodletting has any beneficial effect upon some of these pathological processes.

The way I chose to test that effect was the following: I inoculated rabbits (this is the only animal I experimented upon) with a certain amount of a given poison, which, as was previously ascertained, would kill the animal always at approximately the same time.

Another rabbit of about the same weight and inoculated in the same manner I bled at different times after inoculation. I could thus compare the influence of the inoculation on both animals.

Experiments by others have shown that half the amount of the blood of an animal may be let out and replaced by physiological salt solution without injuring the animal. A few experiments on bleeding performed by me on healthy rabbits corroborated that.

In the first few experiments on bleeding the inoculated animals, I therefore let out nearly that amount of blood, but subsequently I diminished it, believing it to be still too much for an animal weakened by the inoculations.

In every experiment a bleeding was followed by an intravenous injection of physiological salt solution in order to obviate the possibility of a physical action of bloodletting on the blood pressure.

The quantity of physiological salt solution used was nearly double that of the extracted blood. My reason for acting thus was that I noticed in my experiments on normal animals that whenever the quantity of the salt solution exceeded that of the extracted blood, the heart was stimulated quite perceptibly.

I do not think that the subsequent transfusion of the salt solution impaired in any way the results of my work.

The more recent clinical work on venesection always recommended to add to it salt solution transfusion. The transfusion itself is proved to be beneficial in many pathological processes. It therefore emphasizes my results still more. Had I obtained different results, I would have experimented on bleeding without the transfusion of salt solution.

The first poison I used was diphtheria toxine, as that furnishes the most striking and the best studied example of a toxæmia.

I next selected for my inoculations a virulent broth culture of pneumococci, as those are among the bacteria producing a bacterhæmia, and as croupous pneumonia is at the same time a disease for which bleeding has been advocated most strenuously and persistently.

In conclusion I undertook a few inoculations of ricin in order to test the influence of bloodletting on non-bacterial intoxications. I chose that alkaloid because its action has been well studied lately and is so slow as to easily allow bloodletting.

EXPERIMENTS WITH DIPHTHERIA TOXINE:

For this series of experiments I used diphtheria toxine furnished to me by the courtesy of Dr. W. H. Park of the New York Health Department. I ascertained that from 0.25 to 0.3 cc. of that toxine injected subcutaneously invari-

ably killed a rabbit of middle weight in twenty-four to forty-eight hours, while the animals outlived an injection of 0.2 cc. of that toxine. Having thus acquired a criterion for comparison, I began my experiments on bleeding the inoculated animals. I bled the animals always from the external carotid and made the subsequent transfusion through the jugular vein of the same side. When I made a second bleeding and transfusion I left one end of the ligature long and under its guide I always found again the carotid and jugular vein of the same side. In the freed artery I inserted a good sized (veterinary) hypodermic needle with two inches of rubber tubing attached to it. I drew the blood into a graduate and held an artery forceps in readiness in order to clamp the artery as soon as I had drawn the necessary quantity of blood.

The following are the results of my experiments on bleeding rabbits inoculated with diphtheria toxine:

Rabbit No. 1, weighing 1450 gm., was injected 0.3 cc. of diphtheria toxine subcutaneously at 8.45 A. M. At 4 P. M. of the same day I extracted from it 30 cc. of blood and injected 50 cc. of salt solution. The rabbit died at 6 P. M. the following day. It consequently lived 33 hours 15 minutes after the inoculation.

Rabbit No. 2, weighing 1300 gm., was injected 0.3 cc. of diphtheria toxine at 3.30 P. M. At 5.30 P. M. of the same day 30 cc. of blood extracted and injected 50 cc. of salt solution. The rabbit died in 42 hours.

Rabbit No. 3, weighing 1695 gm., was injected 0.3 cc. of diphtheria toxine at 11 A. M. At 4 P. M. of the same day 20 cc. of blood extracted and injected 30 cc. of salt solution. The rabbit died in about 30 hours.

Rabbit No. 4, weighing 1760 gm., was injected 0.3 cc. of diphtheria toxine at 11.30 A. M. At 5 P. M. of the same day 10 cc. of blood extracted and injected 20 cc. of salt solution. The rabbit died in about 30 hours.

Rabbit No. 5, weighing 1550 gm., was injected 0.3 cc. of diphtheria toxine at 3.30 P. M. At 5 P. M. of the same day 10 cc. of blood extracted and injected 20 cc. of salt solution. The rabbit died in about 40 hours.

Rabbit No. 6, weighing 1480 gm., was injected 0.25 of the diphtheria toxine at 3.30 P. M. At 5 P. M. of the same day 10 cc. of blood extracted and injected 20 cc. of salt solution. The rabbit died in about 40 hours.

Rabbit No. 7, weighing 1500 gm., was injected 0.25 cc. of the diphtheria toxine at 3.30 P. M. At 5 P. M. of the same day 10 cc. of the blood were extracted and injected 20 cc. of salt solution. The follow-

ing day at 4 P. M. again 10 cc. of blood were extracted and injected 20 cc. of salt solution. The rabbit died in about 40 hours.

Rabbit No. 8, weighing 1360 gm., was injected 0.25 cc. of diphtheria toxine at 2.30 P. M. At 4.30 P. M. of the same day 10 cc. of blood were extracted and injected 20 cc. of salt solution. At 4.30 P. M. of the following day 4 cc. of blood were extracted and injected 20 cc. of salt solution. The rabbit lived about 36 hours.

The results of these experiments show that the bleeding and salt solution transfusion did not prolong the life of the animals poisoned with diphtheria toxine. I would add that most of the animals not bled looked healthier the last hours of their life than those bled.

The time of death could not always be ascertained exactly, as some of the animals died during the night when there was nobody in the laboratory.

The autopsy of the animals, whether bled or not, did not show any macroscopical changes.

EXPERIMENTS WITH PNEUMOCOCCUS CULTURES.

It is rather difficult to have always on hand a virulent culture of pneumococci. I prepared it in the following way:

Having received a culture through the kindness of Dr. Lambert of the New York Health Department, I injected 1 cc. of it into an ear vein of a rabbit. As soon as the animal died I dipped a sterilized cotton swab in the blood of the heart opened with aseptic precautions, and inoculated with it a tube containing one-third of ascites fluid and two-thirds of broth. I kept that tube in an incubator at 37 degrees C. 24 hours and then let it cool. I did not use my cultures later than three days after inoculation of the tube, and whenever I needed it later, I injected it again into the animal and went through the whole procedure again. Preliminary experiments with these cultures showed that an intravenous injection of from 0.02 to 0.05 cc. of the culture (to get such small doses I diluted the cultures before using in broth) kills a rabbit of middle weight within 24 to 48 hours. The same does a subcutaneous injection of 0.05 cc. But as the virulence

of the cultures is not constant, I was not satisfied with these preliminary experiments and at every experiment on bleeding I injected a control animal from the same culture tube.

Experiment No. 1.—Rabbit No. 9, weighing 1888 gm., and rabbit No. 10, weighing 1750 gm., were both injected at 9.30 A. M. intravenously with 0.05 cc. of the pneumococci culture. At 5 P. M. of the same day 15 cc. of blood were extracted from Rabbit No. 9 and 30 cc. of physiological salt solution injected into it. Both animals died the following morning, *i. e.* about 24 hours after inoculation.

Experiment No. 2.—Rabbit No. 11, weighing 1450 gm., and rabbit No. 12, weighing 1500 gm., were both injected intravenously 0.03 cc. of pneumococci culture at 9 A. M. At 4 P. M. of the same day 12 cc. of blood were extracted and 25 cc. of salt injected into rabbit No. 11. The animal died the following morning at 8 A. M. after 23 hours, while rabbit 12 died at 12.30 P. M., 27½ hours after inoculation.

Experiment No. 3.—Rabbit No. 13, weighing 1850 gm., and rabbit No. 14, weighing 1820 gm., were both injected intravenously 0.02 cc. of pneumococci culture at 9 A. M. At 4 P. M. of the same day 10 cc. of blood were extracted from, and 25 cc. of salt solution injected into, rabbit 13. On the following morning both rabbits were found dead.

Experiment No. 4.—Rabbit No. 15, weighing 1500 gm., and rabbit No. 16, weighing 1450 gm., were both injected subcutaneously 0.05 cc. of pneumococci culture at 11 A. M. At 4 P. M. of the same day 12 cc. of blood were extracted from, and 25 cc. of salt solution injected into, rabbit 15. The following morning rabbit 16 was found dead. Rabbit 15 outlived the inoculation.

Experiment No. 5. Rabbit No. 17, weighing 1700 gm., and rabbit No. 18, weighing 1500 gm., were both injected subcutaneously 0.05 cc. of pneum. culture at 11.30 A. M. At 4 P. M. of the same day 12 cc. of blood were extracted from, and 20 cc. of salt solution injected into, rabbit 17. Rabbit 17 died in about 24 hours, while rabbit 18 died in about 48 hours.

Experiment No. 6.—Rabbit No. 19, weighing 1830 gm., and rabbit No. 20, weighing 1840 gm., were both injected subcutaneously 0.05 cc. of pneumococci culture at 3 P. M. At 5 P. M. of the same day 12 cc. of blood were extracted and 20 cc. of salt solution injected into rabbit 19. The next morning rabbit No. 19 was found dead, while rabbit 20 died only at 11 A. M., *i. e.* it outlived rabbit 19 by at least 3 hours.

Experiment No. 7.—Rabbit No. 21, weighing 1930 gm., and rabbit No. 22, weighing 1770 gm., were both injected subcutaneously 0.05 cc. of pneumococci culture, at 11 A. M. At 5 P. M. of the same day 10 cc. of blood were extracted from it and 20 cc. of salt solution injected into rabbit 21. On the following morning rabbit 21 was found dead. Rabbit 22 died a day later.

This series of experiments, with the exception of Experiment No. 4, also shows that the animals that were bled not only did not improve, but mostly died sooner than those not bled.

As to the results of experiment No. 4, I am unable to account for them, unless that animal was naturally immune against pneumococci, but at any rate it stands alone in all my experiments.

The autopsy of all these animals revealed bloody extravasations in all the serous cavities and in the lungs and enlarged spleen. The animals that were bled showed an anæmic state of parenchymatous organs in comparison with the control animals, and in two cases the lungs of the animals bled contained a visibly smaller quantity of blood than those of the control animals.

EXPERIMENTS WITH RICIN.

The experiments of Flexner¹⁹ show that from a hypodermic injection of 0.005 of ricin, rabbits died within 24 to 48 hours. Taking this for granted, I have made but one preliminary experiment (the rabbit died in 24 hours after the injection). As a precaution, I again had a control animal at every experiment.

Experiment No. 1.—Rabbit No. 23, weighing 1700 gm., and rabbit No. 24, weighing 1560 gm., were both injected hypodermically 0.005 of ricin at 8.30 A. M. At 4 P. M. of the same day 15 cc. of blood were extracted from, and 25 cc. of salt solution injected into, rabbit 23. On the following day rabbit 23 died at 7 A. M., rabbit 24 died at 1 P. M.

Experiment No. 2.—Rabbit No. 25, weighing 1600 gm., and rabbit No. 26, weighing 1420 gm., were both injected subcutaneously 0.005 gm. of ricin at 8.30 A. M. At 5 P. M. of the same day 10 cc. of blood were extracted from, and 20 cc. of salt solution injected into, rabbit 25. On the following day in the morning both animals were found dead.

Experiment No. 3.—Rabbit No. 27, weighing 1540 gm., and rabbit No. 28, weighing 1520 gm., were both injected subcutaneously 0.005 gm. of ricin at 11.30 A. M. At 5 P. M. of the same day 10 cc. of blood extracted from, 20 cc. of salt solution injected into, rabbit 27. On the following day rabbit 27 died in the morning, while rabbit 28 died in the afternoon.

SUMMARY.

It will be noticed that all my experiments were made on entirely healthy animals, and that the animals were inoculated with bacterial toxines or alkaloids.

In other words, the animals were placed in the simplest, or, if the expression be permitted, in the most elementary pathological condition, free from all abnormal secondary complications.

Under such circumstances the effect of a therapeutic agent must be most manifest, and bloodletting, in our experiments, if it was of any effect at all, was deleterious.

In conclusion, while I have certainly been unable to investigate all of the diseases in which bloodletting could have been considered *a priori* of some value or in which it has ever been proposed, still the processes chosen are fair samples of those in which bloodletting should have been of greatest benefit. The results were negative and their uniformity enhances their value.

In what way, then, can it be explained that bloodletting was considered an invaluable remedy during so long a time? In the first place, a healthy organism can endure, and quickly recuperate from, great losses of blood, as we see in cases of placentaprævia, hemorrhoidal and traumatic hemorrhages, and so forth. The dangers of bloodletting are therefore not manifest. Besides, bloodletting was at its acme at a time when the pharmacological inventory was very poor. Bloodletting had to serve instead of such widely different therapeutic measures as heart stimulants, nervous sedatives, salic. of soda, quinine, chloroform, and so on. Of a later day, our forefathers already suspected that pathological processes have something to do with the blood, but tried to explain it in the simplest way. "The blood is diseased," they said, "and part of it, therefore, must be let out." At present we have a much clearer understanding of pathological processes and as a result we have acquired specific measures, such as antiseptics as a preventive against septicæmia, organo- or sero-therapy, etc. Our further work lies in the same

direction: we must look for measures based on our knowledge of the nature of the process and not attempt to apply bloodletting as "a blood-cleaning agent" as Albu¹⁰ puts it.

I deem it a pleasant duty, in concluding my work, to express my thanks to Professor T. M. Prudden and Dr. Ira Van Gieson for help extended to me during my experiments, which were largely done in the laboratory of the Department of Pathology of the College of Physicians and Surgeons, New York.

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CONTRIBUTION TO THE STUDY OF THE BLOOD IN GENERAL PARESIS.

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General paresis is such a well marked form of mental disease that any study of its underlying causative factors presents a special attractiveness that is wanting in many other forms of mental impairment. It is probably due to this fact, in part at least, that so much work has been done in this disease. The blood has received its share of attention.

The most excellent paper of Capps would seem to leave nothing more to be said upon the subject and had not the writer's experience, with some twenty cases observed at the Binghamton State Hospital, pointed to somewhat different conclusions the following study would not be presented.

From the amount of work done thus far, it would appear that broad generalizations upon the condition of the blood are not yet possible. In this paper the writer hopes to present some more facts, not necessarily new, whereby a more correct approximation to the average may be drawn. Insanity is after all a question of averages, and it may be that the blood in general paresis varies within broad lines in much the same manner that the psychical activities vary.

The different observers who have worked upon the blood of general paresis have viewed it from different stand-points. Capps has already briefly recapitulated the work of the earlier authors from Erlenmeyer in 1846 to the present time. Thus Erlenmeyer in 1846 and Hittorf

* It is with pleasure that I here express my obligations to Dr. Chas. G. Wagner for the privilege of spending a summer at the Binghamton State Hospital. My thanks are also expressed to members of the staff of that institution, Drs. Eastman, White, MacCoy, and Eggleston, who made me welcome and did everything in their power to aid me in this and other studies. I am also indebted to Mr. Bert E. Nelson and Mr. M. Boulgourjoo for much assistance in the counting and gathering of specimens.

in 1847 both came to the general conclusions that the number of globules was reduced and that the blood appeared more watery in this disease. Michea and Sutherland both record an increase in the red blood cells, and the latter author states that there is an increase in the leucocytes.

None of these earlier contributions were made with instruments of precision and cannot be regarded as evidence from the present point of view. MacPhail may be considered to be the first author to use such instruments.

MacPhail studied some fifteen or more cases, taking care to observe the distinctions in the different stages of the disease as seen from the clinical standpoint; thus for the first stage his figures run:*

CASE.	DURATION.	HÆMOGLOBIN.	HÆMOCYTES.	LEUCOCYTES.
1 ...	6 months	... 68 per ct.	... 4,450,000	... 15,890
2 ...	12 "	... 62 "	... 4,405,000	... 12,710
3 ...	9 "	... 66 "	... 4,420,000	... 17,000
4 ...	3 "	... 70 "	... 4,515,000	... 14,500
5 ...	4 "	... 65 "	... 4,380,000	... 12,880

Thus all of these cases show a marked decrease of hæmocytetes and a moderate degree of leucocytosis.

If we follow Cabot in his statement, p. 83, that one may expect to find leucocytes varying from 3,000–10,500 in normal cases, and Rieder and Reinert that digestion leucocytosis may reach 33 per cent above the normal, even then MacPhail's figures show leucocytosis. For the second stage the results show:

CASE.	DURATION.	HÆMOGLOBIN.	HÆMOCYTES.	LEUCOCYTES.
1 ...	3 years	... 75 per ct.	... 4,495,000	... 18,000
2 ...	9 months	... 65 "	... 4,380,000	... 19,000
3 ...	1 year	... 72 "	... 4,265,000	... 23,700
4 ...	1 "	... 70 "	... 4,220,000	... 23,400
5 ...	9 months	... 68 "	... 4,265,000	... 30,400

This shows a marked accentuation of the same kind as noted for the first stage, save that the hæmoglobin is higher.

* MacPhail gives his numbers of red cells in percentage of 5,000,000 and his white cells are recorded in proportion to the red ones. These have been calculated so as to bring the results in accord with the scheme of enumeration.

For the terminal stage his figures run:

CASE.	DURATION.	HÆMOGLOBIN.	HÆMOCYTES.	LEUCOCYTES.
1 ...	18 months+	58 per ct.	... 3,880,000	... 27,700
2 ...	16 "	64 "	... 4,055,000	... 28,900
3 ...	8 "	55 "	... 3,445,000	... 31,400
4 ...	6 "	66 "	... 4,525,000	... 34,300
5 ...	9 "	60 "	... 4,020,000	... 36,600

His summary is as follows:

(1)—Hæmoglobin is low on admission, it improves in the second stage and again falls in the third stage.

(2)—The red cells deteriorate in quantity and quality with the progress of the disease.

(3)—Small granule cells are not present in the blood during the last stage.

(4)—Leucocytosis gradually increases as the disease progresses.

Bevan Lewis is quoted by Capps as stating that the red cells are diminished in general paresis. I am unable to verify this statement, as Lewis says: "A diminution of hæmoglobin is clearly indicated in all cases of general paralysis examined by me. The *corpuscular richness* varies considerably, in fact, from 75–126 per hæmic unit, the higher register pertaining to cases where maniacal excitement prevailed. No connection is established, however, between mania and such corpuscular richness, since a diminution in the number of red cells is quite as often, and, in our experience, more frequently, met with in maniacal conditions."

Calculating Lewis' tables, we obtain the following:

CASE.	HÆMOGLOBIN.	RED CELLS.	WHITE CELLS PER HÆMIC UNIT.
1	71 per ct.	.... 6,250,000	.... .40
2	70 "	.... 5—6,000,000	.... .15
3	60—65 "	.... 4,250,000—5,500,000	.... .45
4	58 "	.... 4,560,000	.... .20
5	53 "	.... 4,000,000	.... .35
6	66 "	.... 5,111,000	.... .25
7	68 "	.... 5,030,000	.... .24
8	60 "	.... 4,360,000	.... .32
9 ...	70 "	.... 4,550,000	.... .22

CASE.	HÆMOGLOBIN.			RED CELLS.	WHITE CELLS PER HÆMIC UNIT	
10	62—70	"	....	4,090,000	.... .50
11	64	"	....	3,950,000	.... .20
12	70	"	....	3,920,000	.... .22
13	68	"	....	4,090,000	.... .20
14	"	3,860,000	.... .25
15	64	"	....	.....	.... .10

Smyth has published the longest list of cases, but he made no differential leucocyte counts; but his figures however, we believe, are worth giving.

His conclusions are:

(1)—Hæmoglobin shows no marked changes, the exalted conditions seeming to increase it.

(2)—Red cells lost in melancholia, epilepsy and general paresis, the diminution being least in general paresis.

(3)—The specific gravity is higher then in the normal condition, 1055 being the standard.

His tables (hæmoglobin estimated by Roy's apparatus) are as follows:

CASE.	HÆMOGLOBIN.			HÆMOCYTES.		SP. GR.
1	70 per ct.	....	4,600,000	....	1060
2	80	"	....	5,010,000	.... 1060
3	60	"	....	4,520,000	.... 1059
4	70	"	....	4,250,000	.... 1062
5	65	"	....	4,680,000	.... 1059
6	65	"	....	4,440,000	.... 1062
7	55	"	....	4,620,000	.... 1058
8	58	"	....	4,280,000	.... 1061
9	64	"	....	4,850,000	.... 1061
10	65	"	....	5,200,000	.... 1061
11	70	"	....	4,890,000	.... 1059
12	75	"	....	4,450,000	.... 1049
13	70	"	....	4,620,000	.... 1061
14	65	"	....	4,920,000	.... 1059
15	70	"	....	4,870,000	.... 1059
16	72	"	....	4,680,000	.... 1061
17	74	"	....	4,820,000	.... 1061
18	70	"	....	3,960,000	.... 1061
19	74	"	....	4,980,000	.... 1061
20	70	"	....	4,680,000	.... 1058
21	60	"	....	4,460,000	.... 1060

CASE.		HÆMOGLOBIN.		HÆMOCYTES.		SP. GR.
22	....	58	"	....	4,560,000	.... 1059
23	....	58	"	....	4,280,000	.... 1057
24	....	72	"	....	4,560,000	.... 1062
25	....	68	"	....	4,820,000	.... 1067
26	....	63	"	....	4,920,000	.... 1057
27	....	70	"	....	5,100,000	.... 1056
28	....	70	"	....	4,340,000	.... 1060
29	....	72	"	....	4,860,000	.... 1058
30	....	71	"	....	4,910,000	.... 1058
31	....	72	"	....	4,908,000	.... 1060
32	....	74	"	....	4,701,000	.... 1062
33	....	70	"	....	4,620,000	.... 1060
34	....	70	"	....	5,190,000	.... 1059
35	....	74	"	....	4,500,000	.... 1062
36	....	70	"	....	4,630,000	.... 1060
37	....	74	"	....	4,501,000	.... 1062
38	....	70	"	....	5,160,000	.... 1059
39	....	73	"	....	4,690,000	.... 1059
40	....	76	"	....	4,910,000	.... 1063

Winckler states, from a record of twenty-one cases of general insanity, that hæmoglobin and red cells vary with body weight. They both decrease in the early stage, are stationary in the second stage and again decrease in the third stage.

Krypiakiewicz studied the eosinophiles mainly. In a total of fifteen cases he observed no increase in these cells, and leucocytosis was observed in some cases only. Hæmoglobin and red corpuscles were diminished and poikilocytosis was present.

Zappert gives the following figures for two cases observed by him:

CASE.		HÆMOCYTES.		LEUCOCYTES.		EOSINOPHILES.
1	....	4,200,000	....	7,300	....	Decreased.
2	....	4,100,000	....	8,000	....	1.94 per ct.

Houston published the results of four examinations; his figures were as follows:

CASE.		HÆMOGLOBIN.		HÆMOCYTES.
1	.....	70 per cent.	.....	4,820,000
2	.....	78 "	.....	4,940,000
3	.....	80 "	.....	4,880,000
4	.....	73 "	.....	4,340,000

He does not give any figures of the leucocytes but estimates them to be about normal.

Roncoroni was concerned mainly with the eosinophiles. As quoted from Capps, "These he found to vary, at times very scarce, rarely in normal frequency, in extremely agitated cases with a tendency to violence they increase from 8 to 18 per cent, and, in one instance, even to 25 per cent of the total number of leucocytes."

In Burton's four cases the figures are:

CASE.		HÆMOGLOBIN.		HÆMOCYTES.		LEUCOCYTES.
1	....	75 per ct.	....	6,990,000	....	13,000
2	....	65 "	....	5,260,000	...	10,000
3	....	80 "	....	4,570,000	....	9,000
4	....	72 "	....	3,960,000	....	9,000

No differential counts of leucocytes are given and, as Capps points out, the classification seems involved.

Somers gives the following figures for general paresis, as the average of five cases: Red cells, 4,266,000; white cells, 88,000; hæmoglobin, 74 per cent; eosinophiles in one absent; polynuclear neutrophiles normal in both; poikilocytosis in five; plaques in two; granules in three. Evidently 88,000 is a misprint.

The most exhaustive and by far the best study that we have is that of Capps. His work shows painstaking labor and his results are to be relied upon perhaps even more than those of the present writer, as more time and care were expended in his research. We feel, however, that they do not tell the whole story, hence the publication of this paper. His tables are given on the next page.

Capps' conclusions are as follows:

"In looking over the final table of averages we see that as a whole the hæmoglobin in general paresis ranges from 73 to 92 per cent, never falling below 70 per cent. The percentage is usually higher several months after admission, which is probably due more to hospital care and abundant good food than to any change in the disease.

The specific gravity varies from 1058 to 1066, a difference that may be noted in healthy individuals. The average

CAPPS' TABLES.

Case	White Cells.	Red Cells.	Sp. Gr.	Hæmoglobin.		Lymphocytes.		L. Mono-nuclear.		Transitional.		Poly-nuclear.		Eosino-philes.	
				Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.
1	13,575	5,054,700	1060	86.5		12.7		6.6		1.4		77.3		-	2.
2	8-10,583	4,617,000	1058	81.		12.9		5.		.7		77.9		3.	3.
3	9-13,750	5,154,000	1058.5	87.75		12.4		5.8		1.5		78.8		1.5	1.5
4	12,027	4,499,000	1060.5	82.3		13.9		6.8		1.2		75.7		2.3	2.3
5	10,750	4,760,000	1058.5	87.5		16.6		8.6		1.6		71.9		1.0	1.0
6	13,650	4,724,000	1060	80.5		13.5		8.8		1.5		73.7		2.5	2.5
7	13,750	5,045,000	1059.3	99.		14.1		4.1		.9		78.1		2.8	2.8
8	9,075	4,639,000	1057.5	81.		18.1		5.6		1.1		72.4		1.8	1.8
9	14,720	4,800,000	1065	83.		10.9		10.3		1.5		74.1		3.1	3.1
10	11,660	4,680,000	1058.8	79.8		13.5		4.8		1.7		73.6		6.4	6.4
11	7- 8,467	4,949,000	1061.3	85.6		16.4		12.6		1.		68.6		1.4	1.4
12	14,020	4,989,000	1062	87.5		13.7		8.2		1.1		73.4		3.6	3.6
13	14,330	5,400,000	1065	91.		12.		3.5		.9		83.5		.1	.1
14	11,821	4,957,000	1060.6	81.		10.9		10.4		3.2		66.8		8.7	8.7
15	11,315	4,684,000	1061	79.5		15.9		7.6		1.8		73.1		1.6	1.6
16	9,130	4,196,000	1062	73.3		14.2		8.1		1.		75.6		1.1	1.1
17	13,165	4,660,000	1061	92.		14.5		10.8		2.1		69.5		3.1	3.1
18	13,586	4,808,000	1062.6	85.6		13.9		6.7		1.1		77.4		.9	.9
19	12,650	4,390,000	1065	89.		19.4		12.8		2.6		63.6		1.6	1.6

falls somewhat below the normal, but the tendency is not pronounced enough to make it of any practical importance.

Much more constant is the diminished numbers of red corpuscles which in only four cases reaches 5,000,000. Nevertheless they maintain a much better average than some observers have stated.

The leucocytosis is never very great, but considering that it is present in some degree in the great majority of a large number of observations, we are led to believe that in most cases of general paralysis there is slight leucocytosis, amounting on an average to twenty-two per cent increase over the normal. Of three cases examined within four months of the beginning of the disease, two had no leucocytosis, a third, of longer duration and rapid in its progress, exhibited a decided increase in the white corpuscles. From these few results it seems that *early cases of general paralysis may have no leucocytosis whatever unless accompanied by excitement or running a rapid course.* Nothing further can be said with regard to a correspondence between the degree of leucocytosis and the stage of the disease, since, in many instances, the leucocytes are more abundant in the earlier than in the later stages.

In the analysis of the leucocytes, the lymphocytes, in every case but one, are found to fall below the average. The large mononuclear cells, on the other hand, are generally increased, sometimes to three times the usual number. Roughly speaking, the average increase in the large mononuclears affects the diminution in the lymphocytes so that the total mononuclear element is little altered from the normal. The transitional forms nearly always vary with the large mononuclears. The polynuclear cells as a rule vary directly with the leucocytosis as, with but few exceptions, they are the dominant variety.

The eosinophiles are more changeable than any other form, varying from 14 to 1075 in a c.mm. They are inclined to be more plentiful in the cases that are restless and show motor excitement, although sometimes the reverse is true."

This summarizes the work that has thus far come to the notice of the writer. It can be seen that in the main the results are contradictory, at least enough so to make one look further, for a wider point of view.

Turning now from the researches of others to our own investigations we may consider—

1. Technical methods employed;
2. Investigation of cases;
3. General summary of work.

I.—METHODS.

The blood was obtained from the ear in the greater number of the cases for the estimation of the corpuscles, as well as for the hæmoglobin, and the specific gravity. The counts were made with the regulation Thoma Zeiss apparatus. For the red cells Gowers' dilution fluid was used and the dilution was generally 1—200; a large number of squares was counted, averaging 360. For the white cells the larger bore pipette was used with the $\frac{1}{3}$ of one per cent aqueous solution of glacial acetic acid. Toison's solution was also used, as the acetic mixture was not always satisfactory, as has been pointed out by Ewing and others.

The hæmoglobin was determined in part by the Fleischl hæmometer, in part by Hammerschlag's specific gravity method, though more frequently the two were used and an average made of the results.

The specific gravity was determined entirely by Hammerschlag's method.

Cover glass preparations were made by the ordinary methods, as were also smears, made by means of the glass spreader, the films being much more satisfactory with the spreader, especially from some of the patients who were restless and resistant. Blood from the finger was generally used for the permanent preparations. Fixation was accomplished by means of heat, 110 to 115° C., ten to twenty minutes, and by the mixture of equal parts of absolute alcohol and ether. Heat fixation seemed preferable.

Corrosive sublimate fixation was practiced in a few instances. The preparations were stained by the Ehrlich tri-acid stain and also by the eosin methylene blue methods. Finally specimens were mounted in balsam or in "Naphthaline ambar."

In the differential estimate, from 750 to 1500 leucocytes were counted. The nomenclature adopted for the leucocytes is that given in Cabot's most excellent work.

(a) Basophil cells.

(1) Small lymphocytes. Cells averaging 5 to 10 mikra in diameter with basophilic nucleus generally prominent; the cytoplasm of the cell generally being less observable.

(2) Large mononuclear leucocytes, 10 to 15 mikra in diameter, sometimes even larger, with sub-prominent basophil nucleus and abundant cytoplasm which stains but faintly as a general rule.

(b) Acidophil or oxyphil cells.

(3) Transitional forms. Large cells resembling the large mononuclears but having a nucleus with a marked horse-shoe form which takes up the basic coloring matters more markedly than the nuclei of the large leucocytes.

(4) Polymorphonuclear neutrophiles with single much contorted basophil nucleus or numerous basophil nuclei with neutrophilic granules. These granules are regarded by some observers as the microsomes of the mitoma. These are oxyphil in their staining reactions and generally take up the acid aniline dyes of the fluorescin group, such as eosin, erythrosin, etc.

(5) Eosinophile cells: with irregular nucleus or nuclei and large acidophil granules; these granules being the microsomata of the enlarged mitomata, grown larger. (Gulland).

The time of examination for counting as well as for the determination of hæmoglobin and specific gravity, as has

frequently been pointed out, is of importance. The time chosen was just before a meal, so that leucocytosis would be at a minimum. Digestion leucocytosis would therefore be ruled out. This is just the reverse of the observations of Capps, and our "apologia" of small counts may offset his of increased ones (p. 654, lines 32-33.)

No regular time was observed in the collection of specimens for the differential count of the leucocytes, as digestion leucocytosis, according to Rieder, does not influence the proportions of the different leucocytes to any great extent.

II.—STUDY OF CASES.

CASE I.—J. D., laborer; aged fifty-five years; married. Admitted June, 1896, after two weeks' onset. No heredity. Is said to have been insane years ago in Auburn Prison. Just previous to admission he developed persecutory delusions, and also a fine tremor of the muscles of the face, especially about the mouth. At the present time speech is impaired. At times he works himself up into a marked state of excitement. He will lie upon the floor for hours; will throw his arms and legs about, cry, froth at the mouth and exhaust himself generally. He will then lie quietly for a space of time sufficient to get up enough energy for a second fit of anger. His pupils are contracted; his reflexes are diminished. Nutrition fair. Mental state seems to be improving.

This case is not a typical case of general paresis, and subsequent observations may show it to be another form of mental disease. Up to the present time, however, it seems to belong in this category of cases.

The study of the blood shows an increase in the red cells, the largest number under observation 6,800,000. There was no leucocytosis; the hæmoglobin and specific gravity were not far from normal. The differential count of leucocytes shows a decrease in the young cells of the blood and an increase in the polymorpho-nuclear neutrophiles; eosinophiles about normal.

CASE II.—A. C. S., a painter by occupation; thirty-seven years of age; widower; admitted September, 1897. The duration of the disease has been about fourteen months. His early psychical history shows the development of delusions of wealth in money and in property.

The patient is quiet and orderly, is beginning to be demented somewhat and is amnesic at times. Speech is somewhat slowed and slurred; cannot repeat expressions such as "truly rural," "third cavalry brigade," etc. Is exalted with persistent delusions of wealth. Pupils are unequal, responding to light and accommodation, the reflexes are diminished; has had no convulsions. He persists in writing numerous letters to members of his family, which letters are not legible.

His blood is normal as far as numbers are concerned, and the specific gravity and hæmoglobin are also normal. The differential count of the leucocytes shows a marked diminution in the number of young cells in the blood; a slight increase of the large mononuclear leucocytes and a marked diminution of the polymorphous cells.

CASE III.—J. K., a veterinary dentist by occupation; fifty-five years of age; married; no children. Admitted August, 1896. The family history is negative. The patient has been a heavy drinker. About two months previous to his admission he commenced suddenly to become irritable, especially when crossed. Later, he developed well marked delusions of grandeur. The speech is slowed, though not yet typical of general paresis. There is some mental confusion, and his delusions have become of a hypochondriacal nature. The pupils are equal and react normally; the reflexes are diminished. There have been no convulsions; nutrition good. This case has not yet developed into an absolutely typical case.

The blood is almost normal throughout, save in the diminution of small lymphocytes, where 2.7 per cent instead of from 20 to 30 were recorded.

The case resembles in some respects Case No. II.

CASE IV.—H. H., an engineer; thirty-six years of age; single. Admitted May, 1897. The general hereditary history is negative. Excesses in tobacco and alcohol. After an injury to the head in a railroad wreck, the patient slowly developed a partial paralysis of the right side and aphasia. At the present time he is aphasic, but yells and cries and is markedly depressed at times; no delusions have been elicited. Pupils and reflexes normal; no convulsions. Dementia slight, if any. The time of observation does not permit more than a "suspect" diagnosis of this case.

The blood is practically normal in all respects. The large mononuclear leucocytes run along the higher limits, but the blood is, on the whole, at the normal average.

CASE V.—W. B., salesman; widower; admitted March, 1897. No hereditary history. Alcoholic and tobacco habits. The patient commenced ten months before admission to show signs of mental impairment with gradual onset of feelings of exaltation and of delusions and hallucinations. At the time of admission his speech was slowed and thick. He had many delusions with reference to his own ability and importance and hallucination of sight. Pupils small, equal, reacting normally, reflexes markedly increased; no convulsions. His nutrition is excellent. Dementia has steadily progressed so that at the present time he realizes nothing of his surroundings. Speech is incoherent and all muscular action very incöordinate.

His blood shows an increase in the red blood cells, the leucocytes are diminished or normal. Hæmoglobin and specific gravity slightly below the normal. The differential count of leucocytes shows reduced number of lymphocytes and great increase in the polymorph-neutrophiles.

CASE VI.—D. T. S., veterinary surgeon; single; aged fifty-four. Admitted September, 1896.

One brother was insane. The patient has been a hard drinker, having had four attacks of delirium tremens. The onset of the present disease was somewhat sudden, the early symptoms being delusions of a markedly grandiose character. He has untold millions in every bank in the world, and mountains and mountains of gold; gives checks for fabulous amounts and is God, the Devil, etc. Pupils normal, reflexes are exaggerated; speech somewhat irregular; dementia of second grade. Has recently had five convulsions, lasting five hours. Nutrition good.

The blood shows an increase in the number of red cells and an undoubted leucocytosis; the hæmoglobin and specific gravity are both about normal. The leucocytosis is general, no one particular type of cells seemingly increased beyond the others.

CASE VII.—W. S., telegrapher; married; aged forty-one; admitted September, 1895.

The onset was sudden; occurring ten months before admission into the hospital. Convulsions followed by melancholia with persecutory delusions. His memory then began to fail; this resulted in a loss of his position whereupon the melancholia and delusions of persecution were more marked. Hallucinations of sight developed. Took a pillow as his baby, etc. The delusions persist; the pupils are dilated and the reflexes lost. The patient has locomotor ataxia and presents typical combined symptoms. The case resembles No. VIII very much in

the coexistence of general paresis and locomotor ataxia. The mental conditions of exaltation and feelings of *bien être* alternating with melancholia, is also marked in the two cases.

The blood shows a marked diminution in the number of red cells, the leucocytes are about normal and both the hæmoglobin and the specific gravity are reduced. The distribution of the leucocytes is practically normal; there is a slight diminution in the number of small lymphocytes and the eosinophiles are few.

CASE VIII.—J. J. W., aged 50; single. Admitted December, 1894. Maternal uncle parietic and one brother insane. The patient has been somewhat intemperate. He has suffered from locomotor ataxia for the past ten years with ataxia, and optic nerve atrophy with consequent blindness. Six weeks before admission he became suddenly exalted and emotional; he had grand ideas of his power and importance and was admitted to the Binghamton State Hospital as a case of acute mania. After six months his delusions subsided and his mental tone was markedly improved. He was discharged in June, 1895, as improved. He was readmitted July, 1896, having recently had two convulsions with varying periods of excitement and depression. Ataxia more marked than at the time of previous admission. The other symptoms were characteristic of general paresis. Unequal temperature; 98 on right, 96.4 on left side, varying from side to side. Lost reflexes, pupils unequal; blind; feels temperature changes easily and is readily suggestible. Highly emotional, with strong sexual excitement; cries easily and then laughs. Nutrition is excellent. His delusions are still of the grandiose type, alternating with a certain amount of melancholia. Has had five convulsions since admission. Dementia slight, stationary for a time.

The blood was obtained with difficulty as he was so suspicious. The count showed an increase of red cells; the leucocytes were within the normal range. Hæmoglobin and specific gravity low. The differential count of the leucocytes showed a large number of small lymphocytes, fully up to the higher percentage limit.

In its clinical history this case resembles that of Case VII. The blood was quite different, however.

CASE IX.—J. M., carpenter; married; aged 49. Admitted November, 1895. Mother insane. The disease has had a gradual progress, commencing with a partial loss of memory and fine muscular tremors of face, mouth and tongue. Suffers from depression on

account of his forgetfulness. Since admission has slowly lost ground. Speech is slow, thick and imperfect. Pupils are unequal; reflexes are exaggerated. There have been no convulsions and no well formed delusions. The dementia is steadily progressing. He is orderly and in good physical condition.

The blood is normal throughout, save for the absence of eosinophile cells. These were widely searched for, some several thousand leucocytes having been counted.

CASE X.—J. F., farmer; married; aged fifty-seven. Admitted October, 1895. One sister was insane. The patient commenced to be ill about four months previous to admission into the hospital; he became irritable, and developed delusions of the grandiose type, also somewhat religious; he later became somewhat violent and his language was very voluble and partially incoherent. After admission, continued to be maniacal with persistence of delusions. Pupils unequal; fine tremor of eyelids and muscles of the face; reflexes exaggerated. He occasionally suffers from retention of urine.

In May, 1896, he had severe convulsions, resulting in paralysis of the left arm, leg and side of body; this disappeared in about one month. Since admission, has continued to be exalted, with slowly developing slurred speech and impaired muscular action. Dementia is slow and gradual; about ready to enter the third stage. Has occasional loss of control of bladder and rectum.

The blood is normal, save for a marked increase in hæmocytes, the average of several counts being over six million. Specimens were obtained with some difficulty and stained very poorly, especially so with eosin, although the hæmoglobin was fairly high, 88 per cent.

CASE XI.—F. K., cigar maker; married; aged thirty-three. Admitted December, 1896. No family history. For a year previous to admission he slowly developed delusions of an extravagant and exalted type. Speech also became involved, being slowed and slurred.

The course of the disease has been gradual and typical, evenly progressing muscular and mental paresis. Pupils dilated; reacting; reflexes exaggerated. At present time is entering upon the third stage of filthy habits, but not yet confined to bed. Nutrition is fair.

The blood shows a marked degree of anæmia, the hæmoglobin being about one-half of what it should be; the specific gravity is also low; the hæmocytes are increased; the leucocytes diminished. The differential count of the

leucocytes shows that the reduction is evenly distributed among all of the elements.

CASE XII.—A. Z., cigar maker; married; aged thirty-nine. Admitted December, 1895. No family history. Patient has been intemperate, and for the past few years has suffered from a gradually increasing loss of memory, halting and faulty speech and a slowly progressing dementia. After admission the dementia was the only pronounced symptom, later a fine tremor of the muscles of the tongue developed. In April, 1897, he had a series of convulsions with much muscular twitching. Pupils normal; is confined to bed and develops bedsores which heal slowly. Patient is filthy.

The blood is practically normal throughout, save, perhaps, a slight increase in the number of larger mononuclear cells and the absence of the eosinophiles.

CASE XIII.—A. J. C., laborer; single; aged thirty-nine. Admitted September, 1896. General family history negative. Has taken alcohol in excess. Syphilis. The early history was one of beginning slight dementia with a few convulsions. This was followed by the expression of exalted ideas. He believed himself to be the governor or some other important State or national official. In August, 1896, he had further convulsions. At present in third stage; is weak; reflexes exaggerated, pupils dilated; speech unintelligible.

The blood shows an increase in the hæmocytes and a slight degree of leucocytosis; the specific gravity and hæmoglobin content are slightly decreased. The differential count shows a large number of eosinophiles—7 per cent; the elements are about the average.

CASE XIV.—W. M., bank cashier; married, aged fifty-four. Admitted July, 1894. No hereditary history. Syphilis. The first symptoms noted were beginning slight aphasia; this lasted for a few months and then ceased, to be followed by another slight attack; then the patient commenced to develop delusions of wealth, "he wrecked a bank," etc. For two years was treated at home, but became very delusional and was sent to the hospital. In September, 1894, March, 1895 and August, 1896, had convulsions.

He has passed through the various stages of the disease very slowly, with increasing dementia and weakness. Is now confined to bed and during the time of observation, August, 1897, he had an evening temperature that varied from 99–104, every day.

The blood shows a slight increase in the red cells. Leucocytes are within the average limits throughout, save

a slight increase in the large mononuclear variety. He may have been suffering from some form of fever at the time of observation, but the diagnosis could not be made definitely. There was no leucocytosis, and no unnatural organisms were found.

CASE XV.—I. R., teamster; married; aged fifty-eight. Admitted Jan. 1897. Family history negative. History of syphilis and alcoholism. The onset was rapid. He became irritable, violent and dangerous, with hallucinations of sight and hearing. Had had a slight convulsion.

After admission the patient suffered from great mental and motor excitement for a couple of months. He then became emaciated and weak and was confined to his bed. Appetite is good, but nutrition is bad. Pupils unequal; reflexes all exaggerated. In July, from 1st to 10th, he had three to four convulsions daily, after which the motor and mental paresis advanced rapidly. Dementia and motor paralysis is now almost complete. The patient, however, is in a contented state of mind and tells one that he is "all right."

This is one of the rapid cases of paresis. The blood is almost normal. There was a slight increase in the number of hæmocytes and a reduced percentage of hæmoglobin; the differential count of leucocytes showed a diminution in the lymphocytes and a slight increase in the large mononuclear cells. The eosinophiles were entirely lacking.

CASE XVI.—M. C., laborer; married; widower; aged thirty-six. Admitted September, 1896. Family history unknown. Alcoholic excesses. In September, 1895, the first symptoms commenced to appear: mental confusion, and forgetfulness, causing him to lose his situation. Later a fine tremor developed in his lips and he became melancholic. He gives no history of any delusions. His pupils were dilated and his reflexes exaggerated. The dementia has progressed steadily and at the present stage there is also well marked motor impairment, though as yet he is not confined to bed. He is unable to make himself understood if he tries to talk.

The blood shows an increase in the hæmocytes and a decrease in the leucocytes. The specific gravity is low and the hæmoglobin markedly diminished. The differential count of the leucocytes shows an increase in the large mononuclears, coming chiefly from the small lymphocytes.

CASE XVII.—L. P., female; music teacher; single; aged fifty-five. Admitted March, 1896. One niece is insane. At time of admission was distinctly insane and had been so for three or four years. She was destructive and filthy. Speech was slowed, scanning and incoherent. She had illy defined delusions of persecution and was considerably depressed. Pupils have developed Argyll-Robertson symptoms. The only convulsion occurred quite late in the disease, September, 1897, and was prolonged and severe. She is now a cripple with marked lordosis, and ankylosed knees. Her dementia was profound.

The blood examination was not altogether satisfactory, but the red cells were increased and the leucocytes markedly diminished. The hæmoglobin was not determined, nor was the specific gravity. The differential count of leucocytes showed a marked preponderance of the polymorphonuclear leucocytes and a corresponding diminution of the lymphocytes. There were no eosinophile cells found.

CASE XVIII.—G. H. R., laborer; single, aged forty-four. Admitted June, 1895. No family history obtained. The patient gradually developed delusions of persecution; these were followed by mental confusion; dementia and aphasia soon came on.

The patient also has had chronic rheumatism and endarteritis and endocarditis and suffers from valvular lesions. The pupils have been normal throughout; the reflexes have been generally exaggerated. There have been no convulsions throughout the disease. The general paresis has been gradual, rapid and continuous. The patient died in October, 1897.

The blood contained about the average number of red cells; there was slight leucocytosis; the hæmoglobin and specific gravity were reduced. The differential leucocyte count showed a normal distribution of these elements.

CASE XIX.—S. G., housewife; aged thirty-eight. Admitted May, 1894. There was no family history obtainable. The onset of the disease was slow, first making itself known by mental depression and the beginning of dementia. She became quite emaciated and melancholic, and subsequently developed a host of delusions. At the time of admission she was greatly excited and flew into a violent rage upon the slightest provocation, becoming purple in the face and requiring large doses of hypnotics to keep her orderly. Later she became more quiet and delusions of an exalted nature developed; these alternated with periods of depression.

The pupils have remained normal and the knee-jerks have become markedly exaggerated. The speech has grown more and more slow and difficult and the tremor of the facial muscles marked. The facies were characteristic. During 1896 she gained in flesh.

In 1897 she began to have convulsions. These varied in intensity, at times slight, at others heavy. These would occur at varying periods, happening three or four times a month and then not for a month or more. As the convulsions continued her nutrition decreased. The dementia and the ataxia becoming profound; she died August, 1897.

The examination of the blood was hurried as the patient was practically moribund at the time when the study was begun.

No counts were possible, but a differential count of the leucocytes was secured. This showed diminished lymphocytes and absence of eosinophiles, increase of mononuclear cells and increase of polymorphous cells.

CASE XX.—M. C., housewife; aged forty-nine. Admitted September, 1894. The family and antecedent history is negative. The onset of the malady was gradual. She was irritable and forgetful and began to be slightly demented, later she had a few convulsions and following one had a partial hemiplegia and strabismus, which was however quite temporary (two weeks), the dementia making a distinct advance at that time. In November, 1894, and May, 1895, she had further convulsions and following one of these she had hemiplegia for six or seven days. Her speech gradually became of the characteristic type and her dementia progressed rapidly. Her delusions have always been of a depressed type rather than elated. Pupils were normal and the reflexes exaggerated. Nutrition remained excellent until just before death.

No blood examination was made in the case during life, as she died before the work was started, but a few smears were made post mortem and are here recorded as indications of the condition rather than of anything else, their value as data naturally being *nil*. It is interesting to note that the differential count of the leucocytes was normal, save for the entire absence of eosinophiles.

Tabulated the results are as follows:

Case.	Leucocytes.	Hæmocytcs.	Sp. Gr.	Hæmog.	Lymphoc.	L. Monoc.	Trans.	Polym.	Eosin.
I	4,200	6,800,000	1057	87	12	6	2.5	78	1.5
II	8,600	5,248,000	1059	90	5	10	2	81	2
III	6,950	4,960,000	1056	90	2.7	6.3	3.4	86.5	1.1
IV	6,700	5,040,000	1059	95	24	7	1	66	2
V	5,000	6,520,000	1057	85	8.5	6.5	.5	83	1.5
VI	15,000	6,000,000	1060	95	20	5.5	.5	71	3
VII	6,000	4,000,000	1052	78	15.3	7.7	.5	76	.5
VIII	7,200	5,816,000	1054	75	30	2	2	63	3
IX	4,500	5,456,000	1060	100	27	7	3	63	0
X	7,600	6,766,000	1058	88	20	5	2	71	2
XI	6,100	6,080,000	1047	52	23.5	8.5	4	60	4
XII	6,400	5,300,000	1060	90	15	9	2	74	0
XIII	10,000	6,400,000	1056	80	23	1	1	68	7
XIV	6,400	5,760,000	1060	95	21	16	2	60	1
XV	7,400	5,600,000	1057	80	8.5	10	.5	71	0
XVI	3,400	6,016,000	1047	65	14.5	11	1	71	2.5
XVII	3,500	6,096,000	....	..	4.5	8.5	0	87	0
XVIII	13,000	5,120,000	1050	65	25	5.5	1	66.5	2
XIX	....	.....	....	..	9	9	2	80	
XX	Post mortem	blood.	....	..	24	5	0	71	0

III.—SUMMARY OF OBSERVATIONS. .

If the proper cases are excluded: Cases XIX, XX and perhaps IV; one having died, one having been moribund at the time of observation and one a suspect only, there still remain seventeen cases. In at least fourteen of them the number of red cells was increased, in eight over six million, in the remainder over five million. In two only the hæmocytes were less than five million to the c.mm. With reference to the leucocytes, in four they were below five thousand, seven being below what has been taken as the general average, 7500, and in three only were ten thousand or over recorded. In nearly all the hæmoglobin was reduced and, correlatively, the specific gravity.

Thus the results of Capps and all others with reference to the hæmoglobin and specific gravity, as would be expected, is borne out, but the figures bearing upon the number of red cells and leucocytes are, for the major part, the direct reverse. Looking at the differential count of these seventeen cases it was found that in one the lymphocytes were increased, or, rather, were at the upper limit; in seven normal and in ten decreased. Of the large mononuclear leucocytes, seven cases showed an increase above the limits, as laid down by Cabot, two had a decrease and ten were normal. The poly-morphonuclear elements are averaged from 60 to 70 per cent by Cabot; the counts of the cases recorded show thirteen to be normal and six an increase.

The eosinophiles were increased above the normal in one case only, but it is of interest to record their absence in five cases at least of undoubted general paresis.

In attempting to correlate our results with those of previous observers we would extend the earlier interpretations.

The hæmoglobin may sink below 70 per cent as has been noted in three cases, in one of which 52 per cent was recorded; Lewis records as low as 53 per cent. The specific gravity in our cases ranged from 1047 to 1060, showing a wider range at least downward (Capps 1058).

Capps records an average of twenty-two per cent of leucocytosis. We cannot help but feel that the influence of digestion leucocytosis had not been properly compensated for, although we know that he paid particular attention to that point. The best authorities on physiological leucocytosis allow a variation of thirty-three per cent and, as once noted, Cabot states that one may expect to find in normal human blood all the way from 3000 to 10,500 leucocytes.

The fact seems to remain, that we may expect to find as wide or a wider variation of leucocytes in general paresis than is found in normal blood, but nothing distinctive.

The lower range is indicative of lowered vital tone, and maybe inability to get the best from the food that is provided; and the higher range is found in the cases where a general exalted condition characterizes the type of the disease. The highest register in our cases (15,000) was from such a type.

With reference to the red cells we are unable to account for the slight average grade of polycythæmia unless it is on the ground of a relatively higher altitude. A great number of observers have recorded an increase in the red cells correlated with the increase in altitude. Köppes' lists show that at above 414 and 425 metres the average count runs from 5,754,000 to 5,748,000.

The Binghamton Hospital is about 400 metres above the sea and we may interpret our figures along some such line as indicated. Yet we believe that the limits are within those of health and that as far as the hæmocytes are concerned there is no general rule as far as general paresis is concerned.

With the results of Capps upon the number of lymphocytes, the present observations are in general accord. We note an average reduction in these cases, no one case containing more than thirty per cent, which is recorded as the upper limit of this unit. In general also a relatively high percentage of large mononuclear leucocytes was found, only two being below the normal. Nothing of note was observed of the transitional cells.

In these cases the eosinophile cells showed a wide variation, thus agreeing with the statements of other authors. Their entire absence, however, has not been commented upon.

As a final word of conclusion we cannot but feel that in general paresis there are no marked constant blood changes beyond the reduction in the percentage of hæmoglobin. Perhaps the only point that has been brought out in the résumé of all of the literature is the fact that we may expect to find deficient formation of lymphocytes as evidenced by the generally found diminution of these elements.

The sum of the observations thus far reported would also point to an increase in the large mononuclear leucocytes.

Further study may, however, reveal generalizations of a wider character.

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CHEMICAL AND UROTOXIC INVESTIGATIONS OF FATIGUE IN THE HUMAN SUBJECT.

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I.

On the occasion of the recent six-day bicycle race at Madison Square Garden in New York City, it occurred to me to investigate extreme muscular, nervous and mental fatigue from the chemical as well as the urotoxic standpoint. An occasion similar to this seldom offers itself to the investigator, and on the evening of the fourth day I selected Mr. Miller, who then stood at the head, as a fit subject, for he showed no outward signs of any effect that may have been produced by the terrible strain which a contest of this nature would naturally bring about in the human subject.

Mr. Miller's trainer, Mr. John West, kindly volunteered to furnish me with a twenty-four hour sample of urine, and these were sent me on Saturday, December 11th at 10 A. M. The urine received was passed at 6.45 P. M. on the 5th day of the race, December 10th, (no urine having been passed since early in the morning of that day), and at 2.45 A. M., December 11th, the sixth and last day of the race. Its volume measured 525 ccm., its color was dark amber, clear and slightly alkaline to test paper.

Mr. Miller on Saturday was possessed of all his faculties, and his condition after the race may be judged from the following extracts which I quote from the *New York Times* of December 12, 1897:

While taking a short rest late in the afternoon, Miller was in wonderful form. Save for the fact that his eyes were a little bloodshot, he seemed as if resting from a short ride. He talked rationally, joked, and smilingly shook hands with the many friends who would not be refused admission. He had no desire to sleep, and only wanted to be back on the track adding to his gains on the record. In speaking of his condition, he said he felt "fine."

"It was right after the first twelve hours that I felt badly," he said. "My legs and back troubled me much. Then, when I kept at it I felt better and for the next day it was great. But Tuesday and Wednesday night it was hard. Wednesday night I wanted to quit. Yes, that was the only time I wanted to draw out, but my trainer persuaded me to go back, and I am glad of it."

"After three days' riding, my ankles swelled fearfully, and hurt me a great deal. At times it seemed as if they would not move again, but, when I hung on, the pain went down. Yes, it was the hardest ride I've ever been in. Perhaps the dust was the worst thing I had to fight against. The smoke and the dust got into my lungs and made them sore as well as filling my eyes. No, I did not use glass goggles at all. And I used the same saddle—a hard saddle at that—all the time, and the same wheel, geared all the time to 96. I never had my handle bars padded either."

"About Wednesday," Miller continued, "it was a hard job to keep at it. All I could see was the black mark ahead of me and a dim wall around the track. Every little obstacle, even a nailhead, jarred me fearfully, seeming to shake my bones apart. But the cheering helped. I could grab my handle bars, and push along towards the front every time they shouted for me."

From this account and from the natural inferences of the case, there is no doubt of muscular, nervous and mental exhaustion and fatigue, its being a suitable case for heading.

It might be well to state what was as follows.

Three pounds of boiled rice; half pound of barley, three quarts of water; five dozen pints of grapes and an ounce of which was consumed as follows:

First day: Boiled rice, quarter pound; small bowl of quarts of boiled milk, water; one pint of koun

Off wheel, 1 1/4 hours;

Second day: Boiled rice, quarter pound; bowl of

and lime-water, four quarts; koumyss, one quart; coffee, two and one-half quarts.

Off wheel, $1\frac{1}{2}$ hours; sleep, 45 minutes.

Third day: Boiled rice, one-half pound; oatmeal, two-thirds of a pound; ten apples; milk and lime-water, four and one-half quarts; koumyss, one-half quart; coffee, one and one-half quarts.

Off wheel, about $2\frac{1}{2}$ hours; sleep, 1 hour.

Fourth day: Boiled rice, three fourths of a pound; oatmeal, one-quarter pound; small bowl of barley; twelve apples; milk and lime-water, four quarts; koumyss, one-half quart; coffee, two quarts.

Off wheel, 2 hours; sleep, 50 minutes.

Fifth day: Boiled rice, three-fourths of a pound; oatmeal, one-half pound; bowl of barley; twelve apples; milk and lime-water, four quarts; koumyss, one-half quart; coffee, two quarts.

Off wheel, $1\frac{1}{2}$ hours; sleep, 45 minutes.

Sixth day: Boiled rice, one-half pound; oatmeal, one-quarter pound; two bowls of barley; two apples; milk and lime-water, three and one-half quarts; koumyss, one-half quart; coffee, two and one-half quarts; grapes, one-half pound; two oranges.

Off wheel, 2 hours; sleep, 50 minutes.

From these figures it will be seen that Miller was off his wheel less than half a day in the six, and that he slept a little less than five hours in that time.

The hours of rest and sleep are given with the above table, thus making the programme complete in itself.

As regards the condition of a few of the others who finished in the race, I may mention the following record taken by Police Surgeons Palmer and Johnson at five o'clock on Friday, December 10th:

	TEMPERATURE.	PULSE.	HEART.
Miller,	99° F.	80	Strong and regular.
Hale,	99°	72	Full and strong.
Waller,	98½°	72	" "
Rice,	99°	92	No muscular tremor, and heart strong.
Enterman,	98½°	90	Strong and regular.
Golden,	98°	78	Normal.

It will thus be seen that the condition of Miller differed in no respect from any of his fellow riders, but as he was first in the race and therefore covered more mileage than any of the other competitors, I found it most logical to carry out my investigations upon him.

The chemical analysis of the urine showed the following:

Specific gravity.....	1.0269.	
Total solids.....	5.78 per cent.	
Inorganic solids*.....	1.42	“
Total chlorine**.....	1.394	“
Total phosphate†.....	0.237	“
Preformed sulphates‡.....	0.367	“
Combined sulphates‡.....	0.0174	“
Total nitrogen.....	1.941	“
Urea.....	4.396	“
Ammonia§.....	0.259	“
Uric acid.....	0.1062	“
Na ₂ O||.....	0.504	“
K ₂ O ¶.....	0.532	“

Albumen was absent, which is somewhat remarkable, and the urine on account of its concentration contained a slight excess of indican.

These figures, calculated on the total quantity of the urine passed, 525 c.c., as compared with normal urine for a period of 24 hours, (which the samples obtained may be taken to represent) show the following:

MILLER'S URINE :	NORMAL.
Quantity, 525 c.c.....	1500 c.c.††
Color—Dark amber.....	Yellow.
Sp. gr. 1.0269.....	1.020††
Total solids, 31.164 gms....	72.†† gms. §§

* As sulphates.

§ Calculated as $(\text{NH}_4)_2\text{CO}_3$.

**** Calculated as NaCl.**

|| Calculated as NaCl.

† Calculated as P_2O_5 .

‡ Calculated as KCl.

† Calculated as SO_3 .

†† Parke's figures (Halliburton, *Chemical Physiology and Pathology*, p. 719).

L. G. & Co., 1891, London.

†† Yvon and Berlioz, *Revue Médicale* VIII, p. 713. *Lancet*. II, (1888), p. 629.

§§ This figure is considerably higher than my experience has proven, which is 50 to 60 gms.

Inorganic solids,	7.656 gms....	26.*	gms.	
Chlorides,	7.515 "	19.*	"	
Total P_2O_5 ,	1.278 "	3.16*	"	
Preformed sulphates,	1.979 " }	2.01*	"	
Combined,	0.94 " }			
Urea,	23.700 "	33.18*	"	26.5†
Ammonia,	1.396 "	0.77*	"	
Uric acid,	0.566 "	0.55*	"	
NaCl,	2.717.....	11.09*	"	
KCl,	2.868.....	2.50*	"	

The methods employed by me for the chemical examination were as follows:

Sp. Gr.: By pycnometer at 15°C.

Total Solids: Drying to constant weight at 100° to 105°C.

Inorganic Solids: Ignition with H_2SO_4 .

Chlorides: By Mohr's method, using Na_2CO_3 and $NaNO_3$ instead of NaOH and $NaNO_3$, and titration with $AgNO_3$ solution.

Phosphoric Acid: By titration with uranium nitrate in weakly acid solution.

Sulphates: By Baumann's method.**

Urea: By the Hypobromite method, using Huefner's apparatus for its estimation.

Ammonia: By Schloesing's method.

Uric Acid: By Bartley's volumetric method, titration with silver nitrate in ammoniacal solution.†

Total N: By Kjeldahl's method.‡ Using concentrated sulphuric acid and potassium permanganate for final oxidation.

Alkalies (NaCl, KCl): By weighing combined chlorides of the metals and titrating the total chlorine with $AgNO_3$ and calculating as given by Sutton.§

These figures lead me to make the following deductions from this case of fatigue: The metabolism was greatly reduced in its production of sodium chloride, uric acid,

* Parke's figures (Halliburton, Chemical Physiology and Pathology, p. 719), L. G. & Co., 1891, London.

** Z. f. Phys. Chem. I. p. 70.

† Jr. Am. Chem. Soc., 1897.

‡ Zeitsch. Anal. Chem. XXII p. 366.

§ Sutton's Volumetric Analysis, VII Edition, 1896, pp. 398 and 141.

phosphates and urea, total solids and water, as manifested in the urine. Hoppe Seyler* states that the acidity of perspiration is due to phosphoric acid, and, I infer, the constant perspiration, although not extreme in this subject, carried off the phosphoric acid, which the urine lost. Sodium chloride, water, small amounts of urea and solids might also have been secreted in the same, thus robbing the urine of its normal amount of these constituents.

Urine in this state of concentration may undergo ammoniacal decomposition, even before it leaves the body, especially when retained for such long periods in the bladder (8 hours). This would account for another source of reduction of the amount of urea and a consequent increase in the amount of ammonia present, which my figures show.

As there is no possibility in cases of extreme muscular exertion (the rider having covered about 2,000 miles) for the metabolism to possess a low oxidizing power, it is self-evident that the uric acid, which is a less highly oxidized product than urea, should remain in that state, it will therefore be completely oxidized to urea. This will explain the amount of uric acid being found considerably below the normal figure in the urine examined.

It will thus be seen that the metabolism has not been impaired whatsoever in this case, the variations in the amounts of the few constituents mentioned being easily explained by natural processes occurring in the body of the person engaged in this exercise. We may thus infer that no injury has been done to any organ, since this would have manifested itself in our investigations.

This is proven almost beyond a doubt by the figures obtained and the symptoms noticed in the animals experimented upon in the urotoxic investigation.

RABBIT NO. 1.

Dec. 11, 1897. White rabbit, weight 1.86 kg., received through the lateral veins of the ears, 57 c.c. of this urine in 12 minutes, being at the rate of 1 c.c. in about 13 seconds. The rabbit received 30.5 c.c.

* *Physiol. Chem.*

per kg., and exhibited the following symptoms during the injection:

2.38 P. M. Injection commenced.

2.39 P. M. Respiration regular and deep, after 5 c.c. becoming faster and more superficial. Heart action accelerated.

2.41 P. M. Pupils contracted to one half of normal after 15 c.c.

2.44 P. M. Pupils contracted almost to size of pin-head, after 30 c.c. Gasps in breathing. Respiration short and sharp. Convulsive twitching of muscles of whole body.

2.48 P. M. Convulsive spasm.—Urinated sparingly, after 50 c.c. Gasps in breathing.

2.50 P. M. Death after 57 c.c.

To verify these results I performed another experiment based upon the previous experiment, assuming 30.5 c.c. per kg. to be the toxic dose. I therefore injected an amount slightly below the toxic figure with the following results:

RABBIT NO. 2.

Dec. 11, 1897. Brown rabbit, weight 2.41 kg., received in the same manner as the previous rabbit 22.4 c.c. per kg. or 54 c.c. in 12 minutes, being at the rate of about 1 c.c. in 13 seconds, the same speed as before.

2.58 P. M. Injection commenced.

3.00 P. M. After 10 c.c. pupils contracting.

3.01 P. M. After 15 c.c. pupils contracted to one-half of normal.

3.04 P. M. After 30 c.c. respiration short and sharp.

3.06 P. M. After 40 c.c. pupils contracted to pin-head.

3.10 P. M. After 54 c.c. respiration hurried, about 90 per minute, and fairly deep.

Injection stopped.

3.15 P. M. Rabbit very sick and stupid, falls over on left side, partially paralyzed, respiration short and sharp, but feeble.

Heart action rapid and weak.

3.25 P. M. Respiration as before, falls over on right side repeatedly upon placing in a normal position. Paralysis still continues.

4.30 P. M. More lively, paralysis has disappeared, moves about somewhat.

Dec. 12, 1897, 2 P. M. Stupid and inactive.

Dec. 13, 2 P. M. Still not as lively as normal.

Dec. 14, 3 P. M. Recovering normal temperament.

Dec. 15. Again in normal condition.

This investigation verifies some of Bouchard's results* as to the toxicity of potash salts, especially that of the KCl.

* Bouchard's *Leçons sur les Auto-intoxications dans les Maladies*. Paris, 1887.

The amounts of various constituents present in the 30.5 gms. injected, were as follows, as compared with the amounts present in the toxic dose of normal urine:

	TOXIC DOSE OF MILLER'S URINE.			TOXIC DOSE OF NORMAL URINE.	
Total solids.....	1.8103	gms.	.....	2.40	gms.
Inorganic solids....	0.445	"	.....	0.87	"
Chlorides.....	0.437	"	.....	0.63	"
Total P ₂ O ₅	0.074	"	.....	0.105	"
Preformed SO ₃	0.115	"	}	0.067	"
Combined SO ₃	0.00545	"			
Total N.....	0.608	"	.....	.....
Urea.....	1.377	"	.....	1.106	"
Ammonia.....	0.081	"	.....	0.026	"
Uric acid.....	0.0330	"	.....	0.018	"
NaCl.....	0.158	"	.....	0.37	"
KCl.....	0.167	"	.....	0.08	"

Bouchard gives as the toxic dose of KCl 0.180 gms. per kilogramme of animal, so we find that to the 0.167 gms. of potash salts injected is due most of the toxicity, in fact 92.8 per cent of the total toxicity, which also proves Stadthagen's statement* that 80 to 85 per cent of the toxicity of the urine is due to its contents of inorganic salts.

The ammonia injected is only about one-twentieth of the toxic dose, which is 0.150 gms. per kilogramme. This would leave but three per cent of the toxicity due to the other constituents of the urine, which in all probability is correct, and which I hope to be able to substantiate by work which I am engaged in at present and will soon make public.

The urotoxic investigation bears out in a measure the statements of Bouchard, that the body during the waking and working hours produces narcotic bodies, and in the case of Miller with his low amount of sleep we would expect an abnormal amount of these bodies to be present. The injection of the second rabbit showed us the presence of these bodies in a degree exceeding the normal, for we observed a stuporous and languid condition of the rabbit for a period exceeding 48 hours.

* *Zeitsch f. Kl. Med.* 15 pp. 383-399.

Compared with Bouchard's figures for the toxicity of urine taken after work (during the waking hours), my figures 30.5 cc. compare very favorably with Bouchard's figures, 26.08 cc. per kilogramme of animal. As compared with the urine of 24 hours they are as 30.5:50 (Bouchard's figure).

The urotoxic coefficient of Bouchard being 0.464 against my figures $\frac{525}{30.5 + 72.7} = 0.237$, in other words the urotoxic coefficient is about one-half of the normal figure: one kilogramme of Miller producing enough toxic matter to kill 237 gms. of rabbit, Miller's weight being 160 lbs. or 72.7 kg. Therefore the urine of Miller exhibits a lower toxicity than the normal subject.

It would have been most interesting to have studied the variations in the blood, stomach contents and perspiration from the normal, but as this was not feasible: nay, even impossible in this case, I will be compelled to leave these matters open for further investigations, which I hope to be able to prosecute as the opportunities arrive, and have therefore numbered this paper 1, in anticipation of a continuance of these experiments.

In conclusion, I would ask does the over-exertion in cases like this produce any effect which may be deleterious to the human system, and can the body by careful training not accustom itself to this, regarded by many, as an almost superhuman performance?

I desire to thank my assistant Mr. K. K. Bosse for his earnest efforts in connection with this work.

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REPORT UPON A SERIES OF EXPERIMENTS WITH THE WEIGERT METHODS—WITH SPECIAL REFERENCE FOR USE IN LOWER BRAIN MORPHOLOGY.

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The writer has been engaged for several months upon an investigation, which is still incomplete, of the components of the cranial nerves of the bony fishes. This research has involved the reconstruction from serial sections of the entire courses of the cranial nerves from their nuclei of origin or termination in the brain to their peripheral termini. Upon plots of the cranial nerves, as thus reconstructed, the components of each nerve have been entered, each component having been followed, so far as possible, through the entire course of the nerve from central origin to peripheral end-organ.

Proximally the components are for the most part easily recognized from the nuclei of the brain with which they are related; peripherally the several components of a nerve trunk are again analyzed as they diverge toward their respective end-organs; but in their intervening courses the fibres of the several components are so intimately intertwined that analysis would in most cases be impossible were it not for the fact that the several classes of fibres exhibit well-marked and tolerably constant differences in their size and the character of their myelination. The fibre-characters of each component

are surprisingly similar in all groups of lower vertebrates which have thus far been examined, and the human nerves will, I think, be found also to conform, judging from the rather meager data now available.

It was in the search for methods adequate for this investigation that the experiments described below were undertaken, and this will explain the rather narrow limits between which the experiments were confined and in particular why certain procedures favorable for serial section cutting, such as paraffin embedding, were uniformly adhered to. The technical requirements of the case were indeed rather exacting, for in order to secure Weigert preparations adapted to the purpose we must have, first, absolutely perfect fixation of the medullary nerve sheaths, far more perfect than is ordinarily given in bichromate of potash preparations. Second, perfectly continuous serial sections must be made through the entire head of the animal under investigation; for this purpose ribbon cutting after paraffin embedding offers very obvious advantages over the celloidin method. Third, the specimens, though small, should be adult or nearly so, in order that the medullary sheaths of the nerves may be fully laid down. This point, though not absolutely necessary, is certainly a great advantage. The last condition involves, fourth, quite rigorous decalcification in any bony fish. And this is perhaps the point of chief difficulty, for not only must the tissues, especially the medullated nerves, be well preserved during the process of decalcification, but they must be left in such a chemical condition as to be amenable to the Weigert reaction subsequently. Finally, one has to determine experimentally the particular combination of mordant, stain and decolorizer which will give the clearest results.

The chemistry of the Weigert reactions has not, to my knowledge, been sufficiently worked out to make it possible to predict in advance of actual trial the result of any given combination of fixer, mordant, stain and decolorizer; it is in the hope of sparing some other investi-

gator the weary drudgery of similar blind experimenting that the results of several of my experiments are here published, though the number of failures far exceeds that of successful preparations. It is hoped, too, that these data may be of value in understanding the nature of the Weigert reaction and allied processes.

The same general method of procedure, which has in my hands in some cases given most excellent preparations, has been adhered to throughout the series of experiments, and is to be understood as applying to each case unless otherwise stated. This procedure involves the fixation and decalcification of the specimen entire or nearly so, in large specimens one side of the head being sliced off with a sharp knife and scissors so as to open thoroughly the cranial cavity without injury to the structures in the median line. The specimen is then dehydrated in alcohols, cleared in cedar oil, embedded in paraffin and cut into serial sections by means of a Minot microtome. Cedar oil is preferred to the other clearing oils because, during the long sojourn which is sometimes necessary, its effect is less injurious than that of any other clearing agent. Previous to the embedding or during that process the specimens should be aspirated with a two-way syringe or under the receiver of a good air pump to remove from the cavities of the body the gases evolved during decalcification. If the aspiration is conducted during the stay in cedar oil, the exhaustion should be carried on until the pressure is measured by five to eight mm. of mercury and the specimen held at this pressure for several minutes. By this process large specimens can be permeated as thoroughly with paraffin as with celloidin, though of course the times in all of the solutions, especially in the paraffin bath, must be considerably prolonged. The ribbons may be mounted on the glass slips by means of Mayer's albumen, first flattening them out on warm water if necessary to remove all wrinkles, and after passing out of the absolute alcohol it is well to flow over each slide a very thin solution of celloidin, draining quickly and allowing to set for a

moment before passing down into the lower grades of alcohol. The celloidin film will prevent the loosening of the sections in the staining fluid, which will sometimes occur with any other mode of fixing the sections to the slide, and will in no way interfere with subsequent manipulations, except slightly to retard them. If a thicker film is used the previous use of the albumen may be dispensed with and the film bearing the sections may be cut off from the slides and carried through the subsequent manipulations whole just like an ordinary celloidin section, though for serial section work I much prefer to keep the sections fixed to the slide on which they are to be permanently mounted. With the thin celloidin film the final dehydration should be done in origanum or carbol-xylol, though if the sections are thin I have not usually experienced any difficulty in dehydrating in absolute alcohol, as the stay in the strong alcohol can be so shortened as to remove the danger of the solution of the film. The sections are mordanted and stained on the slide in photographic trays or in staining tubes, the Coplin staining jar (Queen and Co.) being the best jar for the purpose; and in all of my experiments these processes were carried on at the ordinary summer temperature except where otherwise noted. Doubtless some of my results would have been different if the more usual celloidin embedding and mordanting in the block had been followed, and especially if the incubating stove had been employed during the process of mordanting; yet from my experience thus far in the matter I am inclined to think that these are factors of relatively slight importance and that more depends on the relations of chemical affinity within the tissues than upon accidents of temperature and other physical features of that sort, though there is no doubt regarding the value of mordanting and staining at blood heat to shorten the times of these processes.

For the composition of the fluids mentioned, when this is not given, the reader is referred to Bolles Lee's *Vade Mecum*.

In most cases the processes of fixation and decalcification were carried on together by means of the same fluid. First, the more usual decalcifiers, nitric acid, picric acid, etc., were tried in various combinations and these were afterwards replaced by acids which give a more faithful fixation. In the following summary the trials will be arranged first under the head of the fixing fluids, and under each of these the several mordants and stains. Only two kinds of fishes were employed in these tests, *Menidia notata* and *Fundulus hereroclitus*, both small species, and the initial after the serial number in each case indicates which of the two species was employed in that test. All specimens were adult unless otherwise stated.

I.—FIXATION IN NITRIC ACID MIXTURES.

1 *F.* Treated for 18 hours with the following mixture:

Osmic acid,	1.8	g.
Chromic “	2.5	g.
Nitric “	10.	cc.
Water,	400.	cc.

Sections mordanted in copper acetate, half-saturated, warm for three hours; stained in Weigert's hæmatoxylin one hour; and decolorized in Weigert's decolorizer. The result is a characteristic Weigert stain of the nerves, but the tissues are very badly preserved and the preparations utterly worthless. Another specimen fixed in the same mixture for 29 hours was in still worse condition and did not differentiate the nerves under the same subsequent treatment.

2 *F.* Other sections from the specimen last mentioned, mordanted in Erlicki's fluid, stained in the acid hæmatoxylin of Kultschitzky and differentiated by the method of Pal also show no blue fibres.

3 *F.* Still others from the same specimen mordanted in vanadium chloride and aluminum acetate (Wolter's method), stained in acid hæmatoxylin and decolorized in Weigert's decolorizer failed to differentiate the fibres.

4 *F.* Others again, mordanted in Erlicki's fluid, stained in acid hæmatoxylin and decolorized in v. Plessen and Rabinovicz' modification of the fluid of Kultschitzky (equal parts of sat. sol. lithium carbonate and one per cent sol. ferricyanide of potassium), also gave negative results.

5 to 8 *F.* Treated four days with the following mixture:

Chromic acid,	.5	g.
Osmic “	.25	g.
Nitric “	1.25	cc.
Formalin	10.	cc.
Water,	90.	cc.

The tissue was very poorly preserved and the decalcification not complete in the time allowed. The formalin here, as in all other cases, greatly retards the process of decalcification, but leaves the tissue in far better condition than it would be without it. Sections were treated successively as in the four cases first given. None gave satisfactory Weigert preparations, though the copper-mordanted specimen was the most promising.

9 *F.* After hardening in 20 per cent formalin for two days to fix the nerve sheaths, the specimen was decalcified in a mixture of nitric acid and phloroglucin. The medullary sheaths were badly shrunk and with none of the four methods of staining last mentioned could the characteristic Weigert reaction be obtained.

10 *F.* Other sections from the specimen last mentioned mordanted in Erlicki's fluid for three hours, stained in acid hæmatoxylin, then soaked in Müller's fluid and differentiated by the fluid of v. Plessen and Rabinovicz exhibited a very feeble staining of the nerves.

Summary.—None of the mixtures containing nitric acid, including several not mentioned above, gave a satisfactory fixation either of the medullary sheaths of the nerves or of the general tissues, and in most cases subsequent staining by the Weigert methods is impossible, either because the tissue will not take up the stain or because in decolorizing it bleaches uniformly.

II.—FIXATION IN PICRIC ACID MIXTURES.

- 11 *F.* A small specimen was treated for 8 days with,
 Picric acid, saturated in water, 90 cc.
 Acetic " (glacial), 1 cc.
 Formalin, 10 cc.

For complete decalcification further experience shows that a longer time, at least two weeks is necessary. Sections were mordanted for 45 minutes in a 4 per cent solution of iron alum, stained in a $\frac{1}{2}$ per cent solution of hæmatoxylin in water for one hour and decolorized in 2 per cent iron alum. The fixation is good and the axis cylinders are well differentiated. The medullary sheaths are, however, not well preserved and are stained scarcely at all.

12 *F.* Other sections from No. 11 with the same mordant and stain were decolorized in $\frac{1}{2}$ per cent chromic acid. The nerve sheaths are faintly stained but the differentiation is on the whole not so good as the last.

13 *F.* Other sections cut from the same block as No. 11, mordanted in half-saturated copper acetate 4 hours, stained in Weigert's hæmatoxylin 4 hours, refused to take up any of the stain.

14 *M.* The specimen was immersed for one month in the following mixture:

- Picric acid, saturated in water, 90 cc.
 Iron alum,,cryst., 4 g.
 Formalin, 10 cc.

Decalcification was complete and the tissue very well preserved. But sections stained in $\frac{1}{2}$ per cent solution of hæmatoxylin in water for from 15 minutes to 5 hours and decolorized in 2 per cent iron alum failed to differentiate the nerve sheaths properly. The whole tissue decolorized nearly uniformly. Other sections which were treated with Delafield's hæmatoxylin failed to take up any of the stain. Upon staining with Ranvier's picro-carmin the sections show excellent preservation of all the tissues, though the nerve sheaths are badly shrunken.

15 *M.* Sections from the same block as the last, mordanted for 16 hours in 5 per cent potassium bichromate, stained for 6 hours in Weigert's hæmatoxylin and decolorized in Weigert's decolorizer did not differentiate the medullary sheaths and were in worse histological condition than in the previous case. The long soaking in aqueous solutions seems injurious, the nerve sheaths especially being more shrunken.

Summary.—Several other picric acid mixtures were tried, including two of vom Rath's formulæ; but in no case were the nerve sheaths properly preserved, nor did they give satisfactory Weigert stains. I am satisfied, however, that both the picro-acetic-formalin and the picro-iron-alum-formalin are very useful formulæ for general histological purposes, particularly where a slight decalcifying power is required. But the medullated nerves seem to be the tissues for which these mixtures are least adapted, and for the purposes of this research all picric acid combinations were discarded.

III.—FIXATION IN CHROMIC ACIDS MIXTURES.

16 *F.* A small specimen was treated for six days with one per cent chromic acid to which was added 20 per cent of formalin. The decalcification was very slightly advanced, having been retarded by the formalin. Mordanted in section in Erlicki's fluid for 1½ hours, stained in Kultschitzky's acid hæmatoxylin two hours, and differentiated by the method of Pal. The stain is not differential and the tissue very poorly fixed.

17 *F.* Other sections from the same specimen with the same mordant and stain, but differentiated by the method of Kultschitzky (lithium carbonate and ferricyanide of potassium) gave a similar result.

18 *F.* Other similar sections mordanted in Wolter's vanadium chloride and aluminium acetate for 24 hours, stained in warm acid hæmatoxylin for 24 hours, and differentiated with Weigert's decolorizer gave a very

feeble Weigert stain in the medullated nerves, though as before the tissue was badly fixed.

19 *F.* Other similar sections mordanted in half-saturated copper acetate for four hours and stained in Weigert's hæmatoxylin for 19 hours refused to take up any of the stain.

20 *M.* The specimen was treated for two and one-half days with Whitman's modification of Merkel's fluid (chromic acid $\frac{1}{2}$ per cent, platinic chloride $\frac{1}{8}$ per cent). The fluid proved not to be available for the present purpose because it lacks both the necessary decalcifying and permeating power. Some sections which were cut and mordanted for $\frac{1}{2}$ hour in 4 per cent iron alum, stained $2\frac{1}{2}$ hours in $\frac{1}{2}$ per cent aqueous hæmatoxylin and decolorized in 4 per cent iron alum, showed the axis cylinders well stained, but the sheaths poorly preserved and not stained. The interior of the specimen was completely spoiled by the failure of the fluid to permeate.

21 *M.* Other sections from the last specimen were mordanted 3 hours in half-saturated copper acetate, stained 17 hours in Weigert's hæmatoxylin and differentiated with Weigert's decolorizer. Only the outer parts of the sections took up the stain.

Summary.—Chromic acid, like nitric and picric acids, has a very injurious effect upon the nerve sheaths, even when applied in very dilute solutions and for a time far too short to permit of much decalcifying effect. Even in the presence of very strong formalin this injurious effect is still manifest. It is, moreover, in fishes, at least, not favorable for subsequent Weigert's staining.

IV.—FIXATION IN ACETIC ACID MIXTURES.

22 *F.* Treated the specimen for 10 days with a solution containing 2 per cent acetic acid and 20 per cent formalin. The sections were mordanted one-half hour in 4 per cent iron alum, stained one-half hour in $\frac{1}{2}$ per cent aqueous hæmatoxylin and decolorized in 4 per cent iron alum. The decalcifying power of this mixture is very slight,

scarcely any decalcification having been effected in the time given. The general fixation is fairly good, especially for the cells. The nerve sheaths are, however, badly shrunken and the method is not adapted for peripheral nerves.

23 *F.* A half-grown specimen was treated for two and one-half hours with sublimate-acetic (corrosive sublimate saturated in water four parts, glacial acetic acid one part), and the sections mordanted for one-half hour in 4 per cent iron alum, stained for one-half hour in $\frac{1}{2}$ per cent aqueous hæmatoxylin and decolorized in 4 per cent iron alum. The white matter of the brain, peripheral nerves, muscles and most other tissues decolorize almost completely, while the cellular structures are brilliantly stained. The general fixation is very good for the cells of the brain and for most peripheral tissues. The nerve fibres are, however, all very badly fixed and the preparations are valueless for the precise tracing of fibres, either centrally or peripherally.

Mixtures containing acetic and picric acids have already been referred to under the latter head.

Summary.—Acetic acid alone, like chromic acid, has a deleterious effect upon the nerve sheaths; and this effect is exerted even in the presence of formalin solutions sufficiently strong to fix the sheaths well if acting alone. Acetic acid in combination with sublimate has a still worse effect upon the medullated nerves, the white matter of the brain being more or less gelatinized. Other combinations of sublimate which I have tried lead me to condemn it (whatever may be its virtues for other purposes) as a poor fixer for nerve fibres.

V.—FIXATION IN CHROM-ACETIC MIXTURES.

I have found Fol's chrom-acetic a most excellent fixing fluid, not only for general tissues, but especially for the brains of bony fishes. The medullary sheaths of the nerves are, however, less faithfully fixed than most of the other tissues. The addition of formalin to the mixture corrects

this defect in a measure; the fluid has not, however, sufficient decalcifying power for the present purpose. The substitution of formalin for the osmic acid in Flemming's stronger formula gave much better results, as shown by the examples below.

24 *F.* A small specimen (4 cm. long) was treated for seven days with

Chromic acid, 1 per cent,	15 parts.
Glacial acetic acid,	1 "
Formalin,	4 "

The sections were mordanted in Wolter's fluid for 20 hours,

10 per cent vanadium chloride,	2 parts.
8 per cent aluminium acetate,	8 "

They were stained for 24 hours in acid hæmatoxylin and differentiated with Weigert's decolorizer. This gives very excellent preparations. The fixation is good, though not so perfect as the osmic acid fixation to be mentioned beyond. The differentiation is good centrally, but not so brilliant peripherally as desired.

25 *F.* The same fixation, mordant and stain, but decolorized in Kultschitzky's fluid. About the same result as in the last case.

26 *F.* The same fixing fluid as No. 24, applied 14 days, mordanted in 4 per cent iron alum, one-half hour, stained in $\frac{1}{2}$ per cent aqueous hæmatoxylin, one-half hour, and decolorized in 4 per cent iron alum. The fixation is very good peripherally. In the brain we get some shrinkage and fragmentation of sheaths. The nerves stain well and the peripheral tissues decolorize perfectly. This is primarily an axis cylinder stain, though the sheaths can be differentiated also, if not decolorized too far.

27 *F.* The same fixation as the last. The sections mordanted in warm Erlicki's fluid for one hour; stained in warm acid hæmatoxylin one hour; decolorized in Kultschitzky's fluid. This gives a good Weigert preparation with a clear ground peripherally except near the edges.

28 *F.* Same fixation as the last. Sections mordanted

one and one-half hours in warm water half-saturated copper acetate, stained three hours in Weigert's hæmatoxylin and decolorized in Kultschitzky's fluid. The preparations are about like those in No. 27.

29 *F.* Fixation as before. Sections mordanted in Wolter's vanadium chloride and aluminium acetate, four hours, stained in acid hæmatoxylin 3 hours, and decolorized in Weigert's decolorizer. This gives good differentiation centrally, but peripherally the muscles do not decolorize so well as in the last cases.

30 *F.* Fixation as before. Sections mordanted in Weigert's new mordant (saturated copper acetate and 10 per cent sodium potassium tartrate equal parts) for three hours warm, followed by half-saturated copper acetate for two hours; stained in Weigert's hæmatoxylin for two hours; decolorized in Weigert's decolorizer. These are the most satisfactory sections thus far mentioned. The characteristic Weigert reaction is very brilliant both centrally and peripherally and the muscles and other peripheral tissues clear well.

Summary.—Chrom-acetic alone cannot be applied long enough to effect any considerable decalcification without injury to the tissues, especially to the medullary sheaths. The addition of formalin (20 per cent of the whole mixture) in large measure corrects this defect, though the acids should be used rather strong, the proportions used in Flemming's stronger formula giving good results. This fixation permits excellent Weigert preparations and promises well. I found, however, that still better results can be secured by the use of Flemming's fluid, as described below; hence this line of experimentation was discontinued.

VI.—FIXATION IN OSMIC ACID MIXTURES.

Combinations of osmic acid with nitric acid and picric acid have already been mentioned. The osmic acid mixtures which I have found most useful are (A) Hermann's fluid and (B) Flemming's fluid.

A.—Hermann's Fluid.

31 *M.* Specimens fixed for from 2 to 13 days in Hermann's fluid, frequently changed, were cut and mounted directly without further staining. From 3 to 7 days seems sufficient to decalcify ordinary specimens. The tissues are thoroughly blackened, but the nerves most intensely so (except the fat), so that they can in sections easily be followed peripherally. The tissue, however, is so exceedingly brittle that I found it impossible after repeated trials to get satisfactory serial sections. Furthermore the penetrating power of the fluid is so slight that only the outer parts of the specimen are properly fixed. The brain, even when directly exposed by slicing off nearly half of the head, is always in a very bad state of preservation. Peripherally, however, the fixation of the medullated nerves is the most perfect that I have been able to secure by any method, and the imperfect series which I have prepared by this method have been of the greatest use to me, especially when controlled by proper Weigert preparations for the internal courses of the nerves.

A series of experiments was undertaken with a view to determine the staining affinities of the sections hardened in Hermann's fluid, of which a few examples will next be given.

32 *F.* First, several oxidizing fluids were experimented with to test the desirability of decolorizing after hardening in Hermann's fluid by removing the excess of osmic acid from the sections before applying the stains. Peroxide of hydrogen, potassium permanganate, and the decolorizing fluids of Pal and Weigert all clear up the tissue more or less, decolorizing both nerves and muscles.

33 *F.* This specimen was fixed in Hermann's fluid, the sections decolorized in peroxide of hydrogen, mordanted for one-half hour in 4 per cent iron alum, stained for one-half hour in $\frac{1}{2}$ per cent aqueous hæmatoxylin and decolorized in 4 per cent iron alum. The sections are not at all satisfactory, the nerve sheaths being badly shrunken and poorly stained.

34 *F.* Other similar sections were mordanted, without previous decolorizing, in half-saturated copper acetate for 17 hours and stained in Weigert's hæmatoxylin for eight hours; but they refused to take up the stain.

35 *F.* Other sections were first decolorized in peroxide of hydrogen and then treated just like the last, with the same result.

36 *F.* Other sections were mordanted in Wolter's vanadium chloride and aluminium acetate for 17 hours, stained in acid hæmatoxylin for eight hours and decolorized in Weigert's decolorizer. Though they took up the stain, they did not differentiate the nerve fibres when decolorized. Some other sections were first bleached with peroxide of hydrogen and then treated as above with the same result.

37 *F.* Other sections, some bleached with peroxide of hydrogen and some not bleached, were mordanted for two hours in Erlicki's fluid, stained for two hours in Kultschitzky's acid hæmatoxylin and decolorized in lithium carbonate and ferricyanide of potassium, with the same negative result.

38 *F.* Finally some sections, both unbleached and bleached with peroxide of hydrogen, were soaked for two and one-half hours in Weigert's mordant,

Water,	100 cc.
Potasssium bichromate,	5 g.
Chrome alum,	2 g.

followed by half-saturated copper acetate for five hours. They were stained in Weigert's hæmatoxylin and decolorized in Weigert's decolorizer. The result was as unsatisfactory as in the preceding cases.

B.—Flemming's Fluid.

Flemming's second, or stronger formula alone has been employed. This reagent requires a rather longer time for decalcification than Hermann's fluid, from one to three weeks with frequent renewal being required for the head of a minnow. At the end of that time the tissue is, of

course, exceedingly friable, but with very careful handling will hold together sufficiently to cut well and gives perfect serial sections. The fixation is all that could be desired for general purposes and the medullary sheaths are well preserved both centrally and peripherally. The smallest fibres are, however, not quite so well fixed as by Hermann's fluid. In the deeper parts of the specimen they often lose the sharpness of their contours and gelatinize more or less, probably under the influence of the other acids before the osmic acid has sufficiently permeated. The coarse-fibered components are always perfectly preserved even in the interior of the brain. The peripheral tissues are blackened somewhat but not so much as by Hermann's fluid. I had hoped to be able to mount the sections directly after this fixation without further staining, relying on the osmium precipitated in the nerve sheaths to differentiate the fibres, as has been done by others with amphibian and selachian material and as I have done with the bony fishes after fixation with Hermann's fluid. Curiously enough, however, the nerve fibres though well fixed, and that too evidently with the osmic acid, are not at all discolored, but upon dissection the nerves stand out as white cords among the blackened muscles, etc.

39 *F.* Several attempts were made to induce the osmic acid to precipitate in the nerve sheaths. The most successful was by the addition of strong formalin (20 per cent) to Flemming's fluid. The fluid has to be renewed at very frequent intervals, as the osmium is rapidly precipitated from the solution by the formalin. After treatment with this mixture for 24 hours, the decalcification was completed in Flemming's fluid without the formalin (14 days). The general tissues are scarcely at all colored, not even the fat, but in the nerves and central nervous system some of the fibres are a deep black, usually only a few scattered fibres, but sometimes a whole nerve or tract, especially if the fibres are large. The precipitate, however, is opaque and lumpy, and obscures rather than clarifies the minute characters of the nerve sheaths, in this respect quite

unlike the blackening obtained with Hermann's fluid. Experimentation along these lines was soon discontinued, though I found that such sections gave beautiful Weigert preparations by a variety of the methods which give good results with the simple Flemming fixation to be described below.

40 *F.* The entire head of a small adult (about 6 cm. long) was fixed for six days in Flemming's fluid. Though the decalcification was not quite complete, yet a series of sections was obtained and stained with the usual Haidenhain iron-hæmatoxylin (mordant in iron alum, stain in aqueous hæmatoxylin and decolorize in iron alum, as in the previous cases). The fixation is very good. The medullated nerve fibres under a low power are not brilliantly differentiated, yet the high power shows them excellently preserved and the components can be followed, though not so easily as in some of the Weigert methods given below.

41 *F.* Some sections from the last specimen were stained by the method which Keenyon found so satisfactory for the insect brain (Journal Comp. Neurology, Vol. VI, No. 3, p. 138, 1896.) The sections were mordanted in a warm 5 per cent solution of copper sulphate for 1 hour and stained in Mallory's hæmatoxylin,

10 per cent phosphomolybdic acid,	1 cc.
Hæmatoxylin crystals,	1 g.
Chloral hydrate,	6 to 10 g.
Water,	100 cc.

This stain was diluted with water in the proportion of 1 of stain to 5 of water and applied for 1½ hours. The sections are considerably overstained and have to be decolorized for several hours in 70 per cent alcohol. This gives beautiful sections of the central nervous system. The stain is rather diffuse, but cells and fibre tracts are both clearly differentiated. Peripherally, however, the muscles, etc., are so deeply stained that no differentiation of nerves is possible. This stain, though not available for my present purpose, is nevertheless a very useful one for the central

nervous system. It would doubtless be improved by using the dye more dilute and applying for a much shorter time.

One section stained with iron-hæmatoxylin like No. 40 was afterwards stained as above. The result is not so good as either stain separately. A faint counter stain of the iron-hæmatoxylin sections with acid fuchsin or some similar dye is, however, of assistance in differentiating the nerves peripherally.

42 *F.* The attempt to differentiate the peripheral nerve fibres in specimens prepared like No. 41 by decolorizing in Weigert's decolorizer was a disappointment. Peripherally the ground clears fairly well and the nerves can be differentiated from the muscles, etc., much more easily, but this is at the expense of the brilliancy and efficiency of the stain in the central nervous system. Possibly some other decolorizer could be found with which this objection does not prevail.

43 *F.* Vassale's modification of Weigert's process. The specimen was fixed 11 days in Flemming's fluid, sections stained for 5 minutes in Weigert's hæmatoxylin and afterwards mordanted in saturated copper acetate for 3 to 5 minutes, and differentiated with Weigert's decolorizer. The nerves are not differentially stained and the sections are of little value. Other decolorizers were tried also. Pal's was still worse than Weigert's. Kultschitzky's lithium carbonate and ferricyanide of potassium gives better results, especially if the time in the stain is reduced to one half minute. The muscles, etc., are of a deep yellow color and the nerves a pale greyish blue. These are really excellent preparations and the components of the nerves can be clearly analyzed.

This rapid method invites further experimentation. I am inclined to think that with very slight modification it will give sections quite equal to the best of those obtained by the more tedious methods to be described below (e. g. Nos. 46, 53, 54.) This is a true sheath stain, but, like the other Weigert sections made after hardening in Flemming's

fluid to be described next, the stain is very intense at the periphery of the fibres and very faint in the remainder of the medullary sheath, so that under a high power the effect is very different from that of the ordinary Weigert methods. The axis cylinder is a dark yellow, clearly differentiated from the sheath.

44 *F.* Flemming's fluid eleven days, sections mordanted in copper sulphate 2 hours, stained in Weigert's hæmatoxylin one-half hour and decolorized in Weigert's decolorizer. A feeble Weigert stain with poor differentiation both centrally and peripherally.

45 *F.* Flemming's fluid 11 days, sections mordanted in Erlicki's fluid 1 hour, stained in acid hæmatoxylin 1½ hours, dipped in Müller's fluid and decolorized by the method of Pal. This gives fairly good stain centrally, but the muscles do not clear until after the nerves. A longer time in the stain gave still worse results.

46 *F.* Flemming's fluid 11 days, sections mordanted in Erlicki's fluid 1 hour, treated with Kultschitzky's acid hæmatoxylin 2 hours and decolorized with Kultschitzky's lithium and ferricyanide of potassium. The result is splendid differentiation both centrally and peripherally. The nerve fibres are a very intense deep blue and the ground clears well. The stain is a true sheath stain very much like that of No. 43. Cross sections show that in the case of the largest fibres the periphery of the fibre is most deeply stained and that the axis cylinder is decolorized to a clear yellow, while the intervening medullary substance is very faintly tinged with blue. Smaller fibres show the same sharp contour, but the whole of the myelin sheath is stained, though not so deeply as to wholly obscure the axis cylinder. These are, I think, the most beautiful preparations which I have secured, and, though I have not thus far used the method extensively, it will prove without doubt very useful for peripheral nerves.

47 *F.* Flemming's fluid 11 days, sections mordanted in half-saturated copper acetate 21 hours, stained in Kultschitzky's acid hæmatoxylin 3 hours and decolorized with

Weigert's decolorizer. Fairly good differentiation, but by no means so good as the last.

48 *F.* Like the last, but decolorized by the method of v. Plessen and Rabinovicz. About like No. 47.

49 *F.* Like the last, but stained for 5 hours and decolorized by the method of Pal. Very good differentiation of the nerves centrally, but, as in the other cases where Pal's decolorizer was used, the muscles do not clear until after the nerves.

50 *F.* Flemming's fluid 11 days, sections mordanted warm for 4½ hours in Wolter's vanadium chloride and aluminum acetate, stained in acid hæmatoxylin and decolorized by the method of Weigert. This gives very good preparations, about like No. 46, both as to the general low power effect and as to the histological appearance of the fibres under high magnification.

51 *F.* Flemming's fluid 11 days, sections mordanted 21 hours in half-saturated copper acetate, stained in Weigert's hæmatoxylin 3 hours and decolorized by the method of Pal. Very poor; not differential either centrally or peripherally.

52 *M.* Flemming's fluid 11 days, sections mordanted in half-saturated copper acetate 3 hours, stained in Weigert's hæmatoxylin 4 hours and decolorized by the method of v. Plessen and Rabinovicz. The result is poor differentiation. The tissues clear well, but the peripheral nerves clear as soon as the muscles.

53 *M.* Specimens stained as in the last case and decolorized by Weigert's method yielded preparations which on the whole I have found most satisfactory for the purposes of the present research. The nerves are well differentiated both centrally and peripherally. The ground is not so transparent as in some of the other cases, being a light but slightly clouded brown. Nevertheless it clears well except sometimes near the outer surface where there is usually some osmic blackening. Fat is, of course, a deep black, so also are the dermal bones, while the cartilage, calcified cartilage, muscles, connective tissue, nerve cells,

etc., are of the uniform brown color. The failure of the ground to clear so as to become quite transparent is not a disadvantage, but quite the contrary, as it obviates the necessity for counter-staining, while the medullated nerves are stained so intense a blue that they can easily be followed among the other tissues, in favorable preparations even to single nerve fibres. The finest nerve fibres are not, I think, so brilliantly stained as by some of the other methods (*e. g.* Nos. 46 and 50) so that those methods have some points of superiority over this one.

The same method applied to specimens of *Fundulus* about as large as the last resulted in very poor sections. I have no doubt that further experiments upon the times and strengths of the various solutions would much improve these latter preparations; yet the *Fundulus* tissues are apparently more refractory than those of *Menidia* and I doubt if they would under any circumstances yield so good results. Small specimens of the little fresh water sun fish, *Lepomis cyanellus*, when stained by this method, give a still different color effect. The ground is a deep but brilliant bronze color which, though darker than the ground in *Menidia*, yet contrasts equally well with the blue fibres.

The general low-power effect is that of an ordinary Weigert preparation, but under a higher magnification the appearance is quite different, especially when the fibres are examined in cross section. The periphery of the fibre only is stained, but very intensely, so that it appears quite black in the larger fibres. The deeper layers of the myelin are scarcely at all stained and the axis cylinder is decolorized to a clear yellow which is sharply differentiated from the rest of the fibre. The smaller fibres are more uniformly, but more faintly stained.

54 *M.* Specimen fixed for 11 days in Flemming's fluid, mordanted by Weigert's copper acetate and sodium potassium tartrate 2 hours, followed by half-saturated copper acetate 1 hour, stained in Weigert's hæmatoxylin and decolorized by the method of Weigert.

This method here, as after the chrom-acetic fixation, cannot apparently be used exactly as designed by Weigert, i. e. without any decolorizing, but, if properly differentiated with the decolorizer, gives preparations which are very attractive. Though I have not used the method extensively, I think it could with slight further modification be developed into a very valuable method for peripheral nerves. The sections thus far obtained are not so clear, however, as those last mentioned. The histological character of the fibres is about as in No. 46.

After the experiments above described had been performed my attention was attracted by the somewhat similar series of experiments by Bolton* in which Weigert sections of human brains were prepared after mordanting only in osmic acid, and also in a variety of metallic salts. Accordingly I instituted a few further experiments to test the applicability of such a procedure with the fish brain, with results which follow, partly under the present head and partly under the next one (formalin fixation).

55 *M.* The brain of an adult specimen was hardened for four days in Flemming's fluid and after paraffin embedding the sections, without further mordanting, were stained directly in Kultschitzky's hæmatoxylin for two and one-half hours at 40° C. They refused to take up the stain at all, showing apparently that further mordanting is essential.

56 *M.* The same sections, after thorough washing in water, were treated for four hours with Weigert's hæmatoxylin at 40° C. with the same result.

57 *M.* Sections prepared as in the last case were mordanted for three hours at 40° C. in two per cent iron alum and stained in Kultschitzky's hæmatoxylin at 40° for 20 hours. They also refused to take up the stain.

58 *M.* Sections prepared and mordanted like the last, but stained for 20 hours in Weigert's hæmatoxylin at 40° take up the stain well and when decolorized in Weigert's

* Joseph Shaw Bolton. The Nature of the Weigert-Pal Method, Jour. Anat. and Physiol., XXXII, 2, Jan., 1898, p. 247.

fluid yield fairly good preparations, though the stain is feeble. Other sections mordanted for 12 hours cold and stained for five hours give a stronger stain, and yet not wholly satisfactory.

Summary.—Fluids containing osmic acid give the most perfect fixation of the medullated nerves. Hermann's fluid is the best of all, and it blackens the nerve sheaths so well that sections mounted directly without further staining are the best that I have secured by any method for the separation and tracing of coarse and fine fibered components. The tissue, however, is of poor consistency for serial sectioning and furthermore cannot be stained by any of the Weigert processes which I have tried.

Flemming's fluid is the most generally satisfactory fixer. The fixation is nearly as good as that of Hermann's fluid, the decalcifying power is considerable, the tissue is in good histological condition for serial sectioning and permits a variety of excellent Weigert stains. The Haidenhain iron-hæmatoxylin (No. 40) and Mallory's hæmatoxylin after copper mordanting (No. 41) both give very beautiful sections of the central nervous system. Vassale's method (No. 43) promises well and with slight modification gives results which are nearly as good as those of the longer processes. Several of the more usual methods, after slight modification, give very excellent results centrally and peripherally, some using an acid stain (Nos. 46, 50) and some the alkaline stain (Nos. 53, 54). The most successful preparations were all mordanted in copper except No. 50 (vanadium and aluminium). The osmium in the fixing fluid is not of itself a sufficient mordant either for the acid or the alkaline dye. The stain in all of these Flemming-hardened specimens is quite unlike the usual Weigert effect, since the periphery of the myelin only is deeply stained (and this applies both in the brain and in the nerves outside), while the deeper parts of the medullary sheath are stained more feebly or not at all and the axis cylinder usually decolorizes to a yellow or brown like the general ground tissues.

VII.—FIXATION WITH FORMALIN.

Most of the experiments described under this head were suggested, as intimated above, by Bolton's results with human tissue. His methods were repeated in several cases as exactly as possible, but with quite dissimilar results, as we shall see. I am indebted to my pupil, Mr. I. L. Thayer, for assistance in carrying out this series of experiments.

59 *M.* The brain was hardened in 20 per cent formalin for six months, washed in water, embedded and sectioned in paraffin, the sections mordanted for 12 hours in saturated copper acetate and treated with Weigert's hæmatoxylin for six hours. They took up the stain only very faintly.

60 *M.* Mordanting for 16 hours in 5 per cent potassium bichromate and treating for 12 hours with Weigert's hæmatoxylin gave the same result.

61 *M.* Mordanted similar sections in saturated copper acetate for 12 hours, washed and then treated for 16 hours with 5 per cent potassium bichromate and stained for 12 hours with Weigert's hæmatoxylin. They take up the stain to some extent, but upon applying Weigert's decolorizer the white matter bleaches before the grey. I reversed the order of the mordants, first the bichromate, then the copper, with the same result.

Osmic acid, iron alum and ammonium molybdate are the three mordants which Bolton found to give the most satisfactory results with the human brain after six months hardening in 5 per cent formalin. To test their value with the fishes the following experiments were tried:

62 *M.* The brain, which had been hardened for five months in 10 per cent formalin, was washed in water and sectioned in paraffin. The sections were mordanted for 15 minutes in 1 per cent osmic acid, stained for 15 hours in Kultschitzky's acid hæmatoxylin and decolorized by the method of Weigert. This gives a diffuse brown stain with the nerve fibres not at all differentiated.

63 *M.* Other sections were given the same treatment save that they were stained in Weigert's hæmatoxylin. The result is similar, the stain not being quite so intense.

64 *M.* Sections prepared like the last were mordanted for 14 hours in 2 per cent iron alum, stained in Weigert's hæmatoxylin and decolorized by the method of Weigert. This gives a stain similar to the last, though both cells and fibres are slightly better differentiated.

65 *M.* As before, but stained in Kultschitzky's hæmatoxylin, and with the same unsatisfactory result.

66 *M.* Similar sections were mordanted for 14 hours in 2 per cent ammonium molybdate and stained in Kultschitzky's hæmatoxylin. They took the stain only faintly and the fibres decolorized wholly, leaving all nuclei vividly stained.

67 *M.* Like the last, but stained in Weigert's hæmatoxylin. They decolorize wholly with no differentiation.

The six cases last given resemble Bolton's best methods, save that he differentiated by the method of Pal. Having found that in several of these cases that method gave still worse results than the method used, I conclude that none of these methods are adapted to fish tissues. Being very desirous of utilizing formalin hardening material, I next tried several modifications of the method used by Edinger in his studies upon the reptile brain.

68 *M.* The brain, which had been hardened for five months in 10 per cent formalin, was washed in water and then soaked for six days in Weigert's fluid,

Water,	100 cc.
Potassium bichromate,	5 g.
Chrome alum,	2 g.

The sections, cut after paraffin embedding, were mordanted for five hours in warm copper acetate two-thirds saturated, and stained in Kultschitzky's hæmatoxylin for 12 hours. They did not take up the stain properly.

69 *M.* Another specimen was prepared exactly like the last save that the alkaline hæmatoxylin (Weigert's)

instead of the acid stain of Kultschitzky's was used. The sections take up the stain well and when decolorized by the method of Weigert give excellent differentiation.

These sections have a very different appearance from any of the Flemming hardened specimens. The fibres under the high power exhibit the more usual appearance of ordinary Weigert sections, *i. e.*, the fibres, both large and small, are stained a deep blue black, the entire myelinic sheath and the axis cylinder being uniformly colored. Upon further decolorizing the axis cylinder is left deeply stained after the myelin has been almost completely cleared. This is, then, an axis cylinder stain, as well as a myelin stain; the naked collaterals and terminal arborization seem to take up and retain the dye and the "Punksubstanz" is always tinged with blue. All nuclei also retain the color. This, then, is a very useful stain for fishes, as well as for reptiles.

Summary.—Brains hardened in strong formalin have the nerves well fixed, though not so faithfully as osmium hardened specimens. It is an interesting fact that those methods which in Bolton's hands gave the best results upon the human brain fail utterly when applied to fish brains. This is doubtless due to chemical difference in the tissues, for it is well known to all who have worked with the more delicate staining methods that even closely related animals often require different treatment. It is, however, possible to get excellent Weigert preparations of fish brains that have been fixed in formalin by using the method of Edinger (No. 69).

VIII.—FIXATION IN VARIOUS SALTS.

As previously mentioned, the bichromate of potash, which is commonly used as a fixer for Weigert sections, does not preserve the nerve sheaths with sufficient fidelity for my purposes. Strong formalin is, however, a good preservative of nerve sheaths and it was tried in combination with several salts which are known to act favorably as mordants.

70 *M.* A small specimen (3 cm. long, and hence requiring no decalcification) was treated for three days with Kenyon's fluid,

10 per cent potassium bichromate,	40 parts.
5 per cent copper sulphate,	40 "
Formalin,	20 "

After staining with Kultschitzky's hæmatoxylin for five and one-half hours and decolorizing by the method of Weigert, there results a good, though rather faint, Weigert stain. The fixation, however, is not good.

Other slides from the same specimen were further mordanted in section in half-saturated copper acetate for five hours, stained in Weigert's hæmatoxylin four hours and decolorized by the method of Weigert, with negative results. The nerves are not differentially stained.

71 *M.* Another small specimen was hardened for four days in 5 per cent potassium bichromate to which 20 per cent of formalin had been added. The sections were then mordanted in warm Erlicki's fluid for one and one-half hours and stained in warm Kultschitzky's hæmatoxylin for one and one-half hours. They did not, however, take up the stain. The same result followed staining with Weigert's hæmatoxylin.

72 *M.* A young specimen was fixed for 5 days in a mixture composed of iron alum 4 per cent and formalin 10 per cent. Without further mordanting the sections were stained in one-half per cent aqueous hæmatoxylin for three-quarters of an hour and decolorized by the method of Weigert. The result was no differentiation whatever.

73 *M.* Other similar sections stained in Weigert's hæmatoxylin for 15 hours and decolorized in 2 per cent iron alum gave even worse results.

74 *M.* Still other sections stained in acid hæmatoxylin and decolorized in 4 per cent iron alum differentiated the nerve fibres quite well, though not so well as the following.

75 *M.* The best results were obtained by fixing as above, staining in one-half per cent aqueous hæmatoxylin

for an hour or more and decolorizing in 2 per cent iron alum. This gives very brilliant Weigert preparations.

This fixing fluid was devised and suggested to me by Dr. Oliver S. Strong, who has applied it very successfully to the amphibian brain. The fixation is not so perfect as that of the osmic acid mixtures, but better than the usual bichromate. Moreover, it has a very considerable decalcifying power, a point of no small practical value. My specimens of young, but nearly full grown, minnows, were fully decalcified after 5 days' treatment. The stain is absolutely differential, the ground both centrally and peripherally becoming almost perfectly transparent. All nuclei, however, resist the decolorizer more or less, though usually not so much as the nerves. The latter are of a very brilliant light blue color, the dye being confined to the periphery and the axis cylinder of the larger fibres, but staining all of the myelin of the smaller ones. The sections are of exquisite beauty; unfortunately, however, the fixer leaves the tissue very brittle and of a very poor consistency for cutting. This is an insuperable objection to its use in the study of the peripheral nerves, as I have never been able to get satisfactory continuous sections through the whole head. In the case of brain or spinal cord this disadvantage is not so serious.

76 *F.* A small specimen was hardened for 8 days in the following mixture:

Chrome alum, 4 per cent	45 parts.
Iron alum, 4 per cent	45 parts.
Formalin,	10 parts.

It was then left in 10 per cent formalin for a week and embedded and sectioned. The sections were stained in aqueous hæmatoxylin and decolorized in iron alum, as in the preceding case. The fixation is about as before and the stain very similar, though the ground does not clear well. Other decolorizers were not tried. The tissue seems to be in much better histological condition than that fixed in formalin and iron alum alone, and the method merits further study.

Summary.—None of the mixtures of formalin and the metallic salts give wholly satisfactory results. Either the fixation is not perfect or the tissue is of poor consistency for cutting. The most valuable combinations which I have tried are mixtures of formalin and iron alum and formalin, iron alum and chrome alum. These fluids fix well, have considerable decalcifying power and yield the most brilliant sheath stain (and the former the most transparent ground) which I have obtained by any method.

This pre-eminence of the iron alum as a mordant accords with Bolton's results with human tissue, though it is noteworthy that his finest preparations were obtained by simply mordanting for a short time sections of the formalin-hardened brain, while with the fish tissues this method in my hands gave negative results and the tissue must be fixed, as well as mordanted, in the iron salt.

CONCLUDING REMARKS.

Extended commentary upon these experiments is unnecessary, as the results speak for themselves so far as practical utility is concerned and it is not my purpose to enter into an elaborate discussion of the theory of the Weigert stain. The ground covered in the experiments was, as has been stated, determined wholly by the practical requirements of a definite research; nevertheless the peculiarities of the tissues upon which the work was done are such as to cast some light upon the nature of the staining processes.

In this research I have found, as others before me have done, that the fish tissues are refractory to a surprising degree. This does not accord with my own earlier experience, for, in the course of the preparation of an extended series of teleostean brains by ordinary methods (especially Delafield's hæmatoxylin) made several years ago in connection with my brother, it was easy to obtain the most elegant preparations,—preparations which could not be excelled in any other group of vertebrates. But in the present case there were not only the special difficulties mentioned

in the introductory paragraphs, but the presence of the body musculature in the sections imposes other peculiar conditions. It seems that the teleostean muscles and the myelinic nerve sheaths react toward the hæmatoxylin stains very similarly, for they decolorize at very nearly the same time. It was found, for example, in every case where the decolorizer of Pal was tried that the nerves clear before the muscles and in other cases they often clear at about the same moment. This peculiarity destroys the value for peripheral nerves of a number of processes which are very satisfactory centrally. It also sheds some light upon the nature of the staining process.

In the paper by Bolton to which reference has already been made, that author concludes, as a result of an extensive series of experiments upon human brain tissue which had been hardened for several months in five per cent formalin, that, "the Weigert-Pal process is not a specific method for the staining of medullated nerve fibres with hæmatoxylin but is a method of dyeing fibrils which comprises three distinct operations: the mordanting of the fibrils, the formation of a lake in them, and finally, the removal of the stain by oxidation from nearly every other part of the complex tissue under treatment."

This in general I confirm, and also agree with him in finding that other besides nerve tissues may take up and retain the dye, such as blood corpuscles, and nuclei and especially nucleoli of nerve cells. The illustrations which he gives of fibres mordanted in chrome alum and in osmic acid (his Fig. 2) show that only the outer zone of the myelinic sheath is stained, the general effect being similar to the Weigert specimens which I prepared after fixation in Fleming's fluid and mordanting in copper (e.g. No. 53), though it should be noted that all of his figures show that the fibres were very badly fixed in his preparations. The differences in the intensities of stain and colors of the nerve sheaths in Bolton's preparations he attributes to the differences in the mordants and in this he is doubtless in the main correct, for he employed only one kind of

stain (the acid hæmatoxylin) and only one mode of decolorizing.

Now, the failure of any tissue to stain by the Weigert process may be due either (1) to the fact that it does not take up the mordant and hence does not form the lake, or (2) to the fact that the lake formed is there more readily oxidized than the other tissues which resist the decolorizer. The first point is emphasized by Bolton—unduly so, as it seems to me. He says, “Just as fine glass threads included in a web would not stain, so nearly the whole of the fibres in the body, excepting those belonging to the neurons, do not stain owing to the fact that they refuse the mordant and consequently the lake.” But in my experience—and this applies especially to sections containing general as well as nervous tissues—as a rule either the whole section refuses the stain or all of the tissues take it up intensely, and with the slower methods of decolorizing it is clear that the stain is not merely upon, but it is in the tissue elements. It must be admitted that all of these non-nervous tissues, except the blood corpuscles, stain black, not blue, and it may well be that they do not form the same kind of a lake as the myelin of the nerve sheaths. But this applies also to the axis cylinders and to the muscles, in both of which, I infer, Bolton considers that a true lake is formed. The fact that some mordants refuse the acid stain, but under the same conditions take up the alkaline stain and conversely, leads me to believe that a failure to stain may quite as often result from a chemical peculiarity of the tissue after it is mordanted as from a refusal of the mordant.

And this leads to the second point. If the lake is formed what is it which determines whether it will be more rapidly oxidized in one tissue than in another? Bolton believes, apparently, that this condition is simply the permeability of the tissue, “the parenchymatous part of the sections being naturally more readily permeable to the oxidizing agent than the bundles of fibrils, and consequently more readily decolorized.” That this principle operates to a certain extent must be admitted, yet it must

play a very subordinate rôle. It would, I think, be difficult to convince any one who has watched the differentiation by one of the slower methods of Weigert sections cut through the entire body and containing various kinds of tissue that the rate of decolorizing is proportional, however roughly, to the permeability of the tissue. It ill accords with such a view to find that the deeper layers of the myelin sheaths clear before their periphery, that the axis cylinder sometimes decolorizes to a clear yellow still earlier in the process, that the nucleated blood corpuscles of the fishes (a tissue which is certainly sufficiently permeable) may retain their brilliant blue color after all nerves are fully decolorized and the large muscle fibres, transversely cut and hence with their protoplasm directly exposed to the action of the reagents, decolorize nearly as late as medullated nerves and sometimes even later. On the contrary these variations rest upon chemical differences in the tissues which cause them to react differently to the dye. That it is not merely a question of permeability, is clearly shown by the fact that a change from one decolorizer to another is often sufficient to cause a reversal of those conditions, *e. g.*, to cause muscles to decolorize before instead of after the nerves. Such chemical differences, not only between different tissues, but between the same tissue in different animals, are real factors, as is shown by the fact that histological methods which yield a satisfactory stain, say in the Amphibia, may fail completely when applied to the fish, and that even different species of fishes have not the same susceptibility to stains. This receives the most frequent illustration perhaps among the workers with the methylene blue. These staining reactions are far too complicated to be reduced to chemical terms until we know much more of the chemistry of the tissues which take up the stains than we do at present.

I desire in conclusion to express my deep obligation to Dr. Oliver S. Strong for advice and valuable suggestions freely given in the course of these researches.

NOTES ON CRIMINAL ANTHROPOLOGY AND BIO-SOCIOLOGY.*

BEING A STUDY OF SEVENTY-THREE IRISH AND IRISH-
AMERICAN CRIMINALS MADE AT THE KINGS
CO. PENITENTIARY, BROOKLYN, N. Y.

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New York University.

Before entering upon the discussion of these cases I wish to acknowledge my indebtedness to Drs. Homer E. Bartlett, C. O. Stumph, and Yerdon, and to the Warden, Mr. Hayes, for valuable assistance and information given at the prison.

In this country the student of criminal anthropology has to contend with that which, considered from all stand-points but particularly from an anthropometric one, is almost sufficient to merit, before the initiation of his research, the presupposition that his results will be *nil*; the absence of an ethnological standard for the American people of to-day. Finally, after the cessation of immigration, this vast, heterogeneous mass will resolve itself into some distinguishable ethnological condition and develop its own type.

In some sections of this country, New York State for example, the population has already become sufficiently settled and fixed to permit of intelligent and satisfactory results being obtained through the medium of calipers, tape, etc.

This, however, being a matter of futurity, we must select for our subjects those of European birth or of pure European extraction in order that our results be valuable.

With this in view I have collected data referring to 73

* An essay submitted for honorary association with the Pathological Institute of the New York State Hospitals in the Department of Anthropology.

men either Irish by birth or born in the United States of Irish parentage.*†

All of the subjects herein considered were serving at least their second (some their third, fourth, or fifth) terms in prison at the time these examinations were made, and the list includes only two whose crimes had a mental origin aside from acquisitiveness.

The examinations have been divided under the following headings.

- (a) Heredity,
- (b) Environment,
- (c) Anthropometry,
- (d) Special Anthropological Signs,
- (e) Psychical Examinations.

(a)—HEREDITY.

The criminals refusing, as a rule, to give any correct information as to who their relatives or friends are, or where they are to be found, reliance must, to a large extent if not wholly, be placed in their own statements.

For various reasons, sometimes maliciously but more often through a misunderstanding of the motives actuating the queries, many false and purposely misleading answers are given the investigator.

In the following data referring to the heredity and environment of these 73 men I have, by repeatedly examining the same man, been able to eliminate considerable uncertain matter and to give only that which is accurate.‡

Twelve men refused to give any information regarding their parentage or environment, thus reducing the number examined in those particulars to 61. Of this number only

* The district from which the subjects (or their parents) originally came is entirely included in the Province of Munster and County Galway, Province of Connaught. This gives us a mixture of the Saxon and Celtic races, with, possibly, a slight preponderance of the latter.

† The seven subjects reared in asylums while lacking knowledge of parentage were undoubtedly Irish. The exact provinces or counties in Ireland from which they emanated are, of course, unknown.

‡ These examinations extended over a period of about twenty months.

seven could be selected who had any definite knowledge of their grandparents, and two of these were conversant with the history of one side of the family only (one with the paternal and the other with the maternal grandparents).

GRANDPARENTS.

Of these 24 ancestors 15 could not read or write, 8 had more or less education below the grade of our common schools of to-day, and one was a schoolmaster, the graduate of an academy.

All acknowledged religious belief.

Three of the females and all of the males used alcohol habitually and frequently to excess.

There occurred two cases of phthisis and one of epilepsy.* No other diseased conditions could be discovered.

One man was lame "from birth."†

Fifteen of the grandparents are dead, five living, and four remain whose condition, living or dead, is uncertain.

The causes of death: Unknown in 8 cases; apoplexy in 3; phthisis in 2; and violence, 2.

It is impossible, even approximately, to give the correct age at which death occurred, there being too much uncertainty relative to this subject in the minds of the men examined.‡

PARENTS.

In the examinations for defects amongst the parents and the collateral branches of the convicts' families results were obtained in 54 cases, 7 denying all knowledge of parents or of family, their earliest recollections being of asylums.

With the one exception of the ages of the parents at the time of birth of the convicts we will consider the male and female progenitors of our subjects together. Suffice

* Described as "fainting fits," during which the limbs "worked" and after which "there was sleep," (epilepsy is assumed).

† Probably, from the description, hip-joint disease. Not from birth but originating early in life. This would indicate a poor systemic condition.

‡ Taking the figures as they were given, 43 for the males and 47 plus for the females are the averages.

it simply to state that a slightly higher degree of intelligence, and of religious observance, somewhat better education, and more industry existed among the females than among the males.

The results have been reduced to tabular form here, as elsewhere throughout the article.

EMPLOYMENTS OF PARENTS.

Laborers,	21
Farmers,	7
Bartenders,	5
Contractors,	2
Merchant,	1
Clerks,	4
Book-keepers,	2
Jockey,	1
School teacher,	1
Peddler,	1
Houseworkers,	52
Storekeepers, (females),	2
Without occupation,	9
Total,	108

EDUCATION OF PARENTS.

None,	20
Meagre (read and write),	49
Common school (about equal to our primary),	36
Academic,	2
Collegiate,	1
Total,	108

RELIGIOUS TENDENCIES IN PARENTS.

Professing religion and attending church,	94
Non-professing,	14
Total,	108

DISEASES AMONGST PARENTS.

Alcoholic excesses (habitually intoxicated),	15
Epilepsy,	2
Insanity,	2
Phthisis,	10
Paralysis,	1
Total,	30
Percentage diseased,	28 per cent.

DEFORMITIES AMONGST PARENTS.

"Withered Arm" (Probably arrested embryonic development)	I
Harelip,	I
Supernumerary thumb,.....	I
<hr/>	
Total,	3
Percentage of deformities,.....	2.8 per cent.

CAUSES OF DEATH IN PARENTS.

Total number deceased,.....	52
Insanity,	I
Phthisis,	II
Alcoholism,.....	3
Apoplexy,	I
Acute diseases (including one of trauma),.....	25
Childbirth,.....	I
Unknown,.....	IO
<hr/>	
Total,	52

AGE OF PARENTS AT BIRTH OF CRIMINAL.

Males (average),	33 years
Females (average),.....	31 plus.
No. of persons entering into this computation, 57.	
The number of parents deceased was 52.	
The average age at death was 46 plus years.	
Of the 52 still living the average age is 51 plus years.	

COLLATERAL FAMILY BRANCHES.

In extending the enquiries to the brothers and sisters of parents it was found exceedingly difficult to gain much exact information, ignorance on the part of the convicts of all essential features in the lives of their uncles and aunts seeming the rule rather than the exception.

Only twelve men could give even approximate answers. These 12 numbered 47 uncles and aunts:

Healthy,	37
Alcoholic,.....	5
Epileptic,.....	0
Insane,*	2
Phthisis,	2
Paralysis,	I
<hr/>	
Total,.....	47

* These two cases occurred in one family where prisoner's father was also insane.

The brothers and sisters of the convicts numbered 223, the average number of children in each family being 5 plus. Of this number 70 were school children, the remainder being employed as follows:

OCCUPATION OF BROTHERS AND SISTERS OF CONVICTS.

Laborers,.....	35
Tailor,.....	1
Sailors,.....	3
Policeman,	1
Bartenders,.....	9
Bookkeepers,.....	2
Clerks (all grades).....	5
Porters,	7
Soldier,.....	1
Waiters,.....	2
Physician,.....	1
Lawyers,.....	2
Merchant,.....	1
School teachers (both sexes).....	7
Dressmakers and saleswomen,.....	32
Milliners,.....	13
Stenographers and female clerks,.....	9
Sheet-writer (race track),.....	1
Housewomen,	16
No occupation,.....	5
<hr/>	
Total.....	153

DISEASE AMONGST BROTHERS AND SISTERS OF CONVICTS.

Epilepsy,*	14
Insanity,.....	0
Idiocy,.....	1
Phthisis,.....	17
Alcoholic excesses,.....	27
<hr/>	
Total.....	59
Percentage diseased,.....	27 per cent.

Aside from the 223 living brothers and sisters there were 39 who had died from various causes, the majority in infancy or early childhood.

* This includes only cases of motor epilepsy apparent to the convicts and described by them.

There were of the living 17 (12 males and 5 females) who had been in prison once and one who had been convicted several times for various petty offences.

(b)—ENVIRONMENT.

A bad heredity presupposes vicious early environment. Numerous cases occur, however, where a pure heredity is tainted by bad early environment, and *vice versa*.

Drunkenness, poverty, vice, a lack of education, and an absence of religious tendencies, in the parents are, regarding the offspring, the essential features contributing to vicious early environment.

We will consider separately those born in Ireland (16), and those born in the United States (57).

Of those born in Ireland all except one were reared amidst the poverty and intemperance of the poor Irish tenants' hovel home. One, whose father and grandfather were schoolmasters, during his early life was the recipient of good care and careful training, and was possessed of more pleasant surroundings.

Twelve of those born in the United States refused information regarding their homes, etc.

Seven were, early in life, taken by asylums (5 were foundlings and 2 were taken off the street at an early age) and their training directed after the manner of such institutions.

Three were reared amongst abject poverty and squalor, their parents being habitual drunkards, working only when necessity compelled, their subsistence being gained, when possible, through charity or by doubtful means.

Nineteen were sons of parents who worked irregularly, spending much of their substance in alcoholic excesses. Of these, three had no schooling, being compelled to seek their own livings at early ages. The remaining fifteen attended school until the average (about) age of ten years and then sought employment in stores, on the messenger service, as laborers' helpers, etc. All of these (19) were familiar with alcoholic beverages in childhood.

The remainder (16) had from fair to good early surroundings. Two were reared in comparative luxury, wanting for nothing, and had never been forced to seek any occupation as a means of livelihood. Four were from well-to-do families, their earliest recollections being of comfortable homes with an observance of religious forms. The schooling of these six was, 1 academic, 1 collegiate, 1 high school, 3 common school.

Ten were from the homes of prosperous or, at least, comfortably well off mechanics or the better class of laborers, whose homes were comfortable and wherein the training was from fair to good. Only three remembered ever having seen their parents intoxicated though all (parents) drank alcohol to some extent. All these parents acknowledged religious belief and attended church.

Tabulated the results are:

CONVICTS BORN IN IRELAND—WHOLE No. 16.

With good early environment,.....	1
With bad early environment,.....	15
	<hr/>
Total,.....	16

CONVICTS BORN IN U. S.—WHOLE No. 57.

Vicious (worst) early environments,.....	3
Bad early environments,	19
Fair early environments,.....	10
Good early environments.....	6
Reared in institutions (environment questionable),.....	7
Refusing to answer,.....	12
	<hr/>
Total,.....	57

The only data in any manner bearing upon the later environments of the criminals and possible of collection is that referring to their occupations and religious professions (attendance at church).

As for association just prior to imprisonment for the first offense we can only *suppose* they were bad—a supposition which is justifiable and, if made, presupposes certain other conditions hereinafter referred to.

Tables giving this data follow:

OCCUPATIONS OF CRIMINALS (OUTSIDE OF PRISON).

Laborers.....	29
Bookkeepers,	7
Clerks (all grades).....	10
Mechanics (all kinds).....	7
Peddlers,.....	2
Professional man,.....	1
No employment,.....	17
Total,.....	73

OBSERVANCE OF RELIGIOUS FORMS BY CRIMINALS.

Those attending church,.....	50
Those not attending church,.....	23
Total,.....	73

(c)—ANTHROPOMETRY.

The measurements which, like the other data, are tabulated were made after the manner of the French School of Anthropology*.

SEVENTY-THREE CRIMINALS.

Age.

Average,	27 years.
18 to 20 years,	1
20 to 25 years,.....	29
25 to 30 years,	30
30 to 35 years,	10
40 to 50 years,...	2
50 to 65 years,.....	1

Height.†

Average,.....	1.674 m.
Variations—1.50 to 1.55,.....	1
1.55 to 1.60,.....	11
1.60 to 1.65,.....	19
1.65 to 1.70,.....	28
1.70 to 1.75,.....	11
1.75 to 1.80,.....	2
1.80 to 1.82.....	1

* Instructions Anthropologiques Générale—M. Paul Broca.

† Average height of the inhabitants of Provinces of Munster and (southern) Connaught is, according to Dr. Beddoe's computations, 1.74 m.

CRANIAL MEASUREMENTS.

Circumference Max.

Average,.....	56.5 cm.
Variations—51 to 52.9,.....	3
53 to 54.9,.. ..	9
55 to 56.9,.....	27
57 to 58.9,.. ..	29
59 to 59.5,.....	6

SURFACE MEASUREMENTS

Nasion—Inion.

Average,.....	34.1 cm.
Variations—30 to 31.9,.....	3
32 to 32.9,	17
33 to 33.9,	29
34 to 34.9,.....	19
35	1

Nasal Point—Bregma.

Average.	13.21 cm.
Variations—11 to 11.9,.....	3
12 to 12.9,	22
13 to 13.9,	42
14 to 14.9,	6

*Supraauricular Points—Vault.**

Average,.....	27.8+cm.
Variations—23	1
24 to 25.9,	9
26 to 27.9,	31
28 to 29.9,	30
30 to 31.9,	1
32.7	1

* In this, and the four measurements immediately following, the author does not confine himself exactly to the methods of Broca. An imaginary line is taken over the head from the top of one ear to the same point on the opposite side; this divides the skull into two halves and gives the measurement designated as "vault." The other measurements are taken with a tape from the same point and include the maximum and forehead (over frontal eminences) circumferences on the anterior half, and the maximum, and occipital (over occipital protuberance) of the posterior half.

Supraauricular Points—Forehead.

Average,.....	27.8 cm.
Variations—22.7,.....	1
23 to 24.9,.....	10
25 to 26.9,.....	26
27 to 28.9,.....	28
29 to 30.9,.....	5
31 to 31.9,.....	2
32.4.....	1

Supraauricular Points—Maximum.

Average,.....	28.3 cm.
Variations—23 to 24.9,.....	7
25 to 26.9,.....	13
27 to 28.9,.....	25
29 to 30.9,.....	17
31 to 31.9,.....	7
32 to 32.9,.....	2
33 to 33.6,.....	2

Supraauricular Points—Occipital.

Average,.....	23.7+cm.
Variations—19.1,.....	1
20 to 21.9,.....	17
22 to 23.9,.....	33
24 to 25.9,.....	13
26 to 27.9,.....	6
28 to 28.9,.....	2
29 to 29.57,.....	1

Supraauricular Points—Maximum.

Average, ...	24.89+cm.
Variations—20 to 21.9,.....	2
22 to 23.9,.....	15
24 to 25.9,.....	37
26 to 27.9,.....	13
28 to 29.9,.....	5
30.01.....	1

DIAMETERS.

Antero-post. Max.

Average,.....	18.87+cm.
Variations—17.2,.....	1
17.5 to 17.7.....	2
18. to 18.2 incl.,.....	7

Variations—18.3 to 18.	"	.....	11
18.6 to 18.7	"	.....	6
18.8 to 19.	"	.....	19
19.1 to 19.3	"	.....	11
19.4 to 19.6	"	.....	10
19.7 to 19.8	"	.....	4
19.9 to 20.	"	.....	1
20.2		.....	1

Lateral Max.

Average,.....	15.01+cm.
Variations—14,	1
14.1 to 14.2,.....	2
14.3 to 14.4,.....	2
14.5 to 14.6,.....	4
14.7 to 14.8, ..	8
14.9 to 15,	8
15.1 to 15.2,.....	17
15.3 to 15.4,.....	11
15.5 to 15.6,.....	10
15.7 to 15.8,.....	6
15.9	2
16	1
16.5	1

Cephalic Index—(Broca).*

Dolichocephalic, below and incl. 75 per cent.....	2
Subdolichocephalic, 75.01 to 77.77 per cent,.....	16
Mesocephalic, 77.78 to 80 per cent,.....	27
Subbrachycephalic, 80.01 to 83.33 per cent,.....	20
Brachycephalic, 83.34 and above,.....	8

Biauricular.

Average,	13.75+cm.
Variations—11.9.....	1
12 to 12.9,	19
13 to 13.9,.....	31
14 to 14.9,.....	19
15 to 15.2,.....	3

*The average cephalic index (computed from about 1200 examinations made by Beddoe) for the Province of Munster and County Galway is 77.8+per cent, the index being somewhat higher (80.4) in Galway than in parts of Munster (76.7).

Frontal Minimum.

Average,.....	11.87+cm.
Variations— 9.9,.....	1
10 to 10.9,	17
11 to 11.9,	23
12 to 12.9,.....	27
13 to 13.4,.....	4
13.7	1

Bimalar.

Average,.....	12.01—cm.
Variations—10.4,.....	1
10.5 to 10.9.....	3
11 to 11.9,.....	31
12 to 12.9,.....	29
13 to 13.3,.....	8
13.7	1

Bigonial.

Average,.....	10.94+cm.
Variations— 9 to 9.5.....	6
9.6 to 10	7
10.1 to 10.9,.....	39
11 to 11.5,.....	20
11.8	1

Face—Chin to Hairline.

(Observed in 59 cases only).

Average,.....	17.78—cm.
Variations—16 to 16.9,.....	3
17 to 17.9,.....	17
18 to 18.9,.....	29
19 to 19.5,.....	9
19.7	1

Forehead—Nasal Point to Hair Line.

(59 Cases).

Average,.....	5.61+cm.
Variations—4.5 to 4.9,.....	5
5 to 5.4,.....	19
5.5 to 5.9,.....	31
6 to 6.4,.....	2
6.5 to 6.9,.....	1
7.1	1

Eyes—Separation of External Canthi.

Average,.....	9.1+cm.
Variations— 7.5,	1
7.7,	1
8 to 8.4,.....	13
8.5 to 8.9,.....	23
9 to 9.4,.....	28
9.4 to 9.9,.....	4
10 to 10.4,....	2
10.6	1

Separation of Internal Canthi.

Average,.....	2.87+cm.
Variations—1.8.....	1
2. to 2.4,.....	17
2.5 to 2.9,.....	30
3. to 3.4,.....	20
3.5 to 3.9,.....	4
4.2	1

Nasal Index—(Broca).

Leptorrhynian (55 to 69.9),.....	72
Mesorrhynian (70 to 84.9),	1
Variations—55 to 59.9,.....	7
60 to 64.9,.....	47
65 to 69.9,....	18
70 to 74.9,.....	1

Ears.

Average length,.....	6.01+cm.
Average breadth,.....	3.1 +cm.
Variations—5. to 5.4,.....	4
(Length) 5.5 to 5.9,.....	9
6. to 6.4,.....	53
6.5 to 6.9,.....	6
7.1	1
Variations—2. to 2.9,.....	21
(Breadth) 3. to 3.4,.....	36
3.5 to 3.8,.....	16

MEASUREMENTS OF TWENTY NORMAL IRISHMEN.

These measurements were taken for comparison and the cases were not selected, care simply being taken to exclude any of criminal or neuropathic tendencies.

Age.

Average,.....	29 years.
Variations—20 to 25,.....	9
26 to 30,.....	1
31 to 35,.....	7
36 to 40,.....	2
42	1

Height.

Average,.....	1.78+m.
Variations—1.55	1
1.56 to 1.60,.....	2
1.61 to 1.65,.....	3
1.66 to 1.70,.....	6
1.71 to 1.75,.....	4
1.76 to 1.80,.....	3
1.81	1

CRANIAL MEASUREMENTS.

Circumference Max.

Average,.....	54.6 cm.
Variations—51 to 52,	6
53 to 54.9,.....	8
55 to 56.9,.....	2
57 to 58,	4

SURFACE MEASUREMENTS.

Nasion Inion.

Average,.....	3.32+cm.
Variations—31 to 31.9,.....	3
32 to 32.9,.....	4
33 to 33.9,.....	6
34 to 34.9,.....	5
35	2

Nasal Point—Bregma.

Average,.....	12.745 cm.
Variations—11.6 to 11.9,.....	2
12 to 12.9,.....	10
13 to 13.9,.....	8

*Supraauricular Point—Vault.**

Average,.....	28.01—cm.
Variations—25 to 25.9,.....	2
26 to 26.9,.....	3
27 to 27.9,.....	5
28 to 28.9,.....	7
29 to 29.9,.....	0
30 to 30.9,.....	2
31 to 31.9,.....	1

Supraauricular Points—Forehead.

Average,.....	27.9+cm
Variations—23 to 24.9,.....	2
25 to 25.9,.....	2
26 to 26.9,.....	7
27 to 28.9,.....	5
29 to 30.9,.....	2
31 to 31.9,.....	1
32,	1

Supraauricular Points—Maximum.

Average,.....	28 cm
Variations—23.5 to 24.9,.....	2
25 to 25.9,.....	2
26 to 26.9,.....	6
27 to 28.9,.....	5
29 to 30.9,.....	4
31 to 32.3,.....	1

Supraauricular Points—Occipital.

Average,.....	24.37+cm.
Variations—20 to 21.9,.....	2
22 to 23.9,.....	3
24 to 25.9,.....	7
26 to 26.9,.....	4
27 to 28.9,.....	3
29 to 29.37+.....	1

Supraauricular Points—Maximum.

Average,.....	24.9—cm.
Variations—20 to 21.9,.....	2
22 to 23.9,.....	3
23 to 24.9,.....	7
25 to 26.9,.....	4
27 to 28.4,.....	2
29 to 30.9,.....	1
31.3	1

* See foregoing note.

DIAMETERS.

Antero-Posterior, Maximum.

Averages,	18.82 cm.
Variations—17.8 to 17.9,	2
18 to 18.2,	3
18.3 to 18.5,	1
18.6 to 18.8,	4
18.9 to 19	6
19.1 to 19.3,	2
19.4 to 19.5,	2

Nasal Points—Bregma.

Average,	12.745 cm.
Variations—11.6 to 11.9,	2
12. to 12.9,	10
13. to 13.9,	8

*Supraauricular Points—Vault.**

Average,	28.01—cm.
Variations—25 to 25.9,	2
26 to 26.9,	3
27 to 27.9,	5
28 to 28.9,	7
29 to 29.9,	0
30 to 30.9,	2
31 to 31.9,	1

Supraauricular Points—Forehead.

Average,	27.9+ cm.
Variations—23 to 24.9,	2
25 to 25.9,	2
26 to 26.9,	7
27 to 28.9,	5
29 to 30.9,	2
31 to 31.9,	1
32.1	1

Supraauricular Points—Maximum.

Average,	28 cm.
Variations—23.5 to 24.9,	2
25 to 25.9,	2
26 to 26.9,	6
27 to 28.9,	5
29 to 30.9,	4
31 to 32.3,	1

* See foregoing note.

Supraauricular Points—Occipital.

Average,.....	24.37+cm.
Variations—20 to 21.9,	2
22 to 23.9,	3
24 to 25.9,	7
26 to 26.9,	4
27 to 28.9,	3
29 to 29.37+,	1

Supraauricular Points—Maximum.

Average,....	24.9—cm.
Variations—20 to 21.9,	2
22 to 23.9,	3
23 to 24.9,	7
25 to 26.9,	4
27 to 28.9,	2
29 to 30.9,	1
31.3,.....	1

DIAMETERS.

Antero-Posterior Max.

Average,	18.82 cm.
Variations—17.8 to 17.9,.....	2
18. to 18.2,.....	3
18.3 to 18.5,	1
18.6 to 18.8,.....	4
18.9 to 19,	6
19.1 to 19.3,	2
19.4 to 19.5,	2

Lateral Max.

Average,	14.91 cm.
Variations—14.3 to 14.5,.....	5
14.6 to 14.8,.....	4
14.9 to 15	3
15.1 to 15.3,.....	4
15.3 to 15.6,.....	3
15.7	1

Cephalic Index.

Dolichocephalic—below and including 75 p.c.,.....	2
Subdolichocephalic, 75.01 p.c. to 77.77 p.c.,.....	7
Mesocephalic, 77.78 p.c. to 80. p.c.,	9
Subbrachycephalic, 80.01 p.c. to 83.33 p.c.,.....	2

Biauricular.

Average,	13.345 cm.
Variations—12 to 12.2,	2
12.6 to 12.9,	3
13 to 13.2,	5
13.3 to 13.5,	4
13.6 to 13.8,	2
13.9 to 14	2
14.1	1
14.5	1

Frontal Minimum.

Average,	11.59 cm.
Variations—10.4 to 10.9,	4
11 to 11.9,	11
12 to 12.9,	3
13 to 13.2,	2

Bimolar.

Average,	11.70 cm.
Variations—10.9	1
11 to 11.9,	12
12 to 12.9,	7
13	1

Bigonial.

Average,	10.495 cm.
Variations—9.7 to 9.9,	3
10 to 10.5,	8
10.6 to 11	6
11.1	2
11.7	1

Face—Chin to Hair Line.

(Observed in 16 Cases).

Average,	17.30+cm.
Variations—16.1	1
16.5 to 16.9,	6
17 to 17.9,	6
18 to 18.1,	2
19.5	1

Forehead—Nasal Point to Hair Line.

(16 Cases).

Average,	5.425 cm.
Variations—4.9	1
5 to 5.4,	9
5.5 to 5.9,	5
6.2	1

Eyes—Separation of External Canthi.

Average,	8.55 cm.
Variations—7.9	1
8 to 8.4,	9
8.5 to 8.9,	5
9 to 9.4,	4
9.6	1

Separation of Internal Canthi.

Average,	2.995 cm.
Variations—2.5 to 2.9,	6
3 to 3.4,	9
3.5 to 3.9,	4
4.1	1

Nasal Index.

Leptorrhynian—55 to 69.8,	17
Mesorrhynian—70 to 84.9,	3
Variations—55 to 59.9,	3
60 to 64.9,	9
65 to 69.9,	5
70 to 74.9,	2
75.5	1

Ears.

Average length,	5.76 cm.
Average breadth,	3.095 cm.
Variations—5.3 to 5.5,	6
Length 5.6 to 5.9,	7
6 to 6.5,	7
Variations—2.5 to 2.9,	5
Breadth 3 to 3.4,	13
3.6	1
3.7	1

AVERAGES.	73 CRIMINALS.	20 NORMAL MUNSTER IRISHMEN.
Age, (18 to 65).	27 years.	29 years.
Height,.....	1.674 m.	1.78 +m.
Circumference of head-max,...	56.5 +cm.	54.6 +cm.
Nasion-inion,.....	34.1 cm.	33.2 +cm.
Nasion-bregma,.....	13.21 cm.	12.745 cm.
<i>Supraauricular Points:</i>		
Vault,.....	27.8 +cm.	28.01 cm.
Forehead,.....	27.8 cm.	27.9 +cm.
Maximum,.....	28.3 cm.	28 cm.
Occipital,	23.7 cm.	24.37 cm.
Maximum,.....	24.89 cm.	24.9 cm.
<i>Diameters:</i>		
Antero-posterior-max.....	18.87+cm.	18.82 cm.
Lateral max.,.....	15.01+cm.	14.91 cm.
Biauricular,.....	13.75+cm.	13.345 cm.
Frontal min.,.....	11.87+cm.	11.59 cm.
Bimalar,.....	12.01—cm.	11.70 cm.
Bigonial,.....	10.94+cm.	10.495 cm.
Chin-hair line (59 cases),.....	17.78—cm.	17.30 cm.*
Forehead (nasion hair line) (59 cases),	5.61+cm.	5.425 cm.*
<i>Ears:</i>		
Length,.....	6.01+cm.	5.76 cm.
Breadth,.....	3.1 +cm.	3.095 cm.

(d)—SPECIAL ANTHROPOLOGICAL SIGNS.†

Number of child of parents—1st,.....	30
2d,.....	9
3d,.....	11
4th,.....	1
5th,.....	2
6th,.....	1
Total,.....	54

In studying the cranium it is desirable to employ every method which will enable us to bring out the details of the deformities (if they exist).

* Observed in 16 cases.
† Elements d'anthropologie générale.—P. Topinard.

It is obvious that if reliance were placed solely upon findings with calipers and tape it would necessitate (especially in studying the living subject) such a vast number of separate measurements that the resulting figures would be hopelessly confusing. It has seemed desirable, therefore, to make an outline drawing of the contour of the head which will show the deformity at a glance and more accurately than could be hoped for by the mere employment of measurements.

While it is possible to introduce herein only a limited number of these drawings (Plates 1 to 18) they are sufficient to show the general plan of procedure and the usual head formations found in the present subjects. These few plates show deformities which, while each varies somewhat from the other, may be properly spoken of as characteristic of all of the present 73 subjects who presented asymmetry of the head (71).

In the drawings the smaller irregularities of outlines mean nothing, being the result of similar small irregularities in the lead used in taking the shapes.

The essential points of deformity are shown somewhat in the greater irregularities, but are particularly brought out by noting the difference in distance from the median line to the outer margin of the outline on the two sides, at corresponding points.

In some cases this difference is so marked throughout the entire half of the head as to give the impression that the median line had been misplaced in the drawing.

In the majority of cases, however, it will be noted that the differences of the two sides are most marked about the anterior parietal, temporal and frontal portions.

While I am not prepared to insist that there is any particular significance in this fact it seems probable that such deformity, situated over the centres of the higher associations as it is, might account for a considerable degree of mental irregularity.

Autopsy upon a subject presenting these deformities would probably show a brain somewhat smaller upon the

deformed side, the convolutions flattened, and sulci less deep and clearly defined. I have had, however, no opportunity to verify this supposition.

By following the above methods in the present cases the following conditions have been established:

CONTOUR OF HEADS OF CRIMINALS.

Perfect symmetry.....	2
Slight asymmetry,.....	42
Marked asymmetry,.....	29
Total,.....	73

Deformities of the ear having, from the studies of the insane by Morel, Binder, Stahl and others, taken high rank as stigmata of degeneracy, were carefully studied in these criminals, and part of the same classification given as that used by Peterson* (after Binder). Though Peterson divides malformation of the ear into twenty-two varieties, only a few of the most important are herein used.

- (a) No crus superius; no antihelix; small fossa concha; few details of ear,..... 31
- (b) No lobule; almost no fossa concha; shallow fossa scaphoidea; fusion of helix; antihelix, and antitragus, (A type of the Stahl ear No. 3),..... 12
- (c) Prominent antihelix; mal-developed helix; absence of lobule; diminution of concha. (Wildermuth ear No. 1), 11
- (d) Darwin ear (Darwinian tubercle),..... 3
- (e) Triplication of crura furcata; malformed helix and antitragus; absent lobule,..... 2
- (f) Broad band-line helix; no antihelix; no lobule; excessive size of fossa cymbæ,..... 7
- (g) Elephant ear. (Stahl ear No. 1),..... 1
- (h) Abnormal implantation of ears; too marked conchoidal shape. (The Morel ear),..... 5
- (i) Blainville ears,..... 1
- (j) Excessive length of ears,..... 7†

There were no diseases of the ear discovered. Deafness was present in one man.

* STATE HOSPITALS BULLETIN, July, 1896.

† The seven cases of excessive length of ears occurred in connection with other forms above noted.

COLORS AND DISEASES OF THE EYES; DISORDERS OF VISION.

Brown,.....	3
Gray,	24
Black,	6
Blue.....	40
Diseases of the eyes—acute, 5; chronic, 1,.....	6
Defective vision,.....	9

The palpebral fissures were more narrow than normal in 24 subjects.

The eyes were obliquely placed in 11 men.

Flecks upon the iris in 7 subjects were the only anomaly of the eye proper observed.

A slight internal strabismus was observed in one man.

There was marked facial asymmetry apparent, on inspection, in 15 men, and slight irregularity in 37.

NOSES OF CRIMINALS.*

Elev. Rect—Base hor.,.....	32
" elev.,.....	18
" desc.,.....	0
Elev. Concave—Base hor.,.....	1
" elev.,.....	2
" desc.,.....	0
Elev. Convex—Base hor.,.....	0
" elev.,.....	1
" desc.,.....	1
Elev. Hump—Base hor.,.....	13
" elev.,.....	1
" desc.,.....	0
Elev. Undulating—Base hor.,.....	3
" elev.,.....	1
" desc.,.....	0

FOREHEADS OF CRIMINALS.

High,...	2
Narrow,.....	17
Prominent,.....	1
Low,.....	13
Receding,.....	4
Medium,.....	35
Broad,.....	1
Total,.....	73

* After Alphonse Bertillon.

HAIR OF CRIMINALS.*

Black,.....	12
Light chestnut,.....	20
Dark chestnut,.....	12
Sandy,.....	28
Red,.....	1
Excessive in quantity (on face, head and body),.....	9
Medium in quantity (on face, head and body),.....	37
Scant in quantity (on face, head and body),.....	27

Regarding the quality of the hair, where it was profuse it was coarse and wiry and where scanty, fine and silky. In the majority of cases (51) the beards were thin. It was impossible to observe the condition of the hair (whether curly or straight) as it was, in the majority of cases, closely clipped.

Many irregularities of the denture were found; irregular insertion of the teeth being the rule. Perfectly regular denture occurred in only ten subjects. Many teeth were missing. The following table shows the conditions found:

TEETH OF CRIMINALS.

Sound,.....	12
Poor—Enamel too hard,.....	7
Enamel too soft (much worn teeth),.....	52
Hutchinson,.....	2†

Deformities of the hard palate are generally considered as important marks of instability. Numerous forms of classifying these deformities are used by the various authors, but such terms as "Gothic," "horse-shoe," etc., being rather ambiguous a simpler method is here resorted to.

No measurements were made, the following table being the result of inspection:

High, narrow, medium,.....	9
" " short,.....	5
" " long,.....	3

* Dr. Beddoe reports a preponderance of brunetness, about 20 to 1, in the district from which these subjects came.

† In one of these cases hereditary syphilis existed but in the other no history or evidences of that disease were present.

High, broad, medium.....	0
“ “ short,.....	1
“ “ long,.....	0
Low, narrow, medium,.....	2
“ “ short,.....	3
“ “ long,.....	0
“ broad, medium,.....	19
“ “ short,.....	3
“ “ long,.....	1
Asymmetrical,.....	27
Total,.....	73

Scars were found in far greater numbers than on any other class, except, perhaps, the epileptic.

Tattooing, in various designs, more or less remarkable, was found on 53 men. The proportion of those tattooed being 72+ per cent.

The patellar reflexes only were examined. They were exaggerated in 31, normal in 39, and diminished in 3 subjects.

The urine was excessive and light colored in 31 cases,* being normal in the remainder.

The bowels were, as a rule, constipated.

With the exception of the heart the internal organs were not examined. The results of the cardiac examinations were:

CARDIAC AUSCULTATION.

Normal (sound and rythm),.....	39
Valvular murmurs,.....	2
Extra forcible heart beat (cardiac hypertrophy),.....	1
Irregularity of rythm,.....	31
Total,.....	73

The circulation of the blood was normal in 36 subjects. Four had an over active circulation, and in 33 men the circulation was poor.

In general appearance 33 fell below the standard, *i. e.*, were anæmic, 36 appeared about normal, and 4 were particularly robust.

* These 31 cases were the same in which there was an exaggerated patellar reflex.

Comparative tests of the muscular development of the arms, back and chest were made, with the following results:

MUSCULAR DEVELOPMENT OF CRIMINALS.

Over developed (great strength),.....	1
Medium development,.....	39
Under development,.....	33
Total,.....	73

Pigmentary deposits in the skin and nævi occurred in 13 subjects.

In the following table only the chronic diseases found amongst the criminals are considered:*

DISEASES OF CRIMINALS.

Epilepsy (motor),.....	9
Hystero-epilepsy,.....	1
Hysteria,.....	1
Phthisis,.....	3
Syphilis—hereditary, 1; acquired, 2,.....	3
Marked anæmia,.....	7
Total,.....	24
Percentage diseased,.....	33

SENSIBILITY.

The sense of pain was exaggerated in 33 men over isolated areas of greater or less extent.†

A slight degree of lessened pain sense was present in 18 men. In these this anæsthesia was generally distributed.

The sense of pain was normal in 22 men.

The temperature sense was not taken.

* Regarding diseases of childhood dependence had to be placed in the prisoners' statements; there were four cases of chorea and 7 of infantile convulsions.

Mr. Bruce Thomson, surgeon to the General Prison of Scotland, says: "In all my experience I have never seen such an accumulation of morbid appearances as I witness in the post-mortem examinations of the prisoners who die here. Scarcely one of them can be said to die of one disease, for almost every organ of the body is more or less diseased."

† Thirty-one of these cases were those in which there was some extra excitability of the reflexes, marked anæmia, and the habitual passage of large quantities of light colored urine. Their general condition was distinctly neurasthenic.

Tactile sense, dull in 7 subjects, about normal in 27, and acute in 39.

A feather drawn over the surface of the body caused unbearable tickling in 37 men; 13 were annoyed but could stand the tickling; 23 experienced little if any sensation.

SLEEP.

Light sleepers, dreamless,.....	3
Light sleepers, with dreams—pleasant, 12; unpleasant, 18,.....	30
Heavy sleepers, dreamless,.....	22
Heavy sleepers, with dreams—pleasant, 1; unpleasant, 17	18

(e)—PSYCHICAL EXAMINATIONS.

These examinations were usually made by leading the subject into general conversation, noting his ideas and making deductions therefrom. The results, therefore, may partake somewhat of the nature of personal equations, though, as no leading questions were asked, they are, in their general way, accurate.*

Regarding the dispositions of the men, there was much dissimilarity though a majority (41) were sullen, suspicious and complaining. Of the remainder a large number were mild in manner and either timid or sneaking; these indulged, as a rule, in protestations of or in acts intimating humility, though evidently with the motive of arousing sympathy. Only a small number were naturally bold and self-reliant, accepting their situation philosophically. Three were reckless under the restraint of prison discipline, indulging in overt acts of disobedience and submitted to repeated punishments without the latter having the smallest influence upon their subsequent actions. Selfishness was a marked characteristic in all the subjects. Abnormal egoism accompanied it.

Memory was in matters pertaining directly to them-

* Acting upon the suggestion of Dr. Boris Sidis I subsequently examined some of these subjects (13) by giving them short series of numerals and letters, both written and spoken, as memory tests. These tests resulted in proving more conclusively what I had previously decided; that memory was defective. I regret that they were not systematically employed, during the regular examinations, in every case.

selves exceedingly good, while upon the topics of days immediately passed and upon which they had thought it was poor or indifferent.

The general intellectual qualities were peculiarly developed. In some matters they were acute and along other lines approached almost to imbecility.* Only six men seemed possessed of well-balanced intellects.†

There was a general lack of appreciation or comprehension of the higher principles as applied, particularly to the actuation of motives. That they knew that others would act without a *personal* motive or the view of future *personal* gain was evidenced by their own actions in seeking favors at the hands of visitors and kind-hearted officials, but the low opinion in which their benefactors were held proved that unselfish origin of action was foreign to themselves.

There were two cases in which there were occasional hallucinations, one visual and one auditory. Thirty-seven of the subjects were liable to periods of intense excitement, longer or shorter in duration.‡

The moral sense was, in all the subjects, perverted, and two seemed absolutely to lack all conception of moral law.

A lack of inhibitory control was marked in each of the seventy-three subjects.

Remorse for crime committed was not present in any case.

Criminal slang was used by 31 of these subjects, though all seemed to understand the jargon.

* This is a similar condition to that found by Dr. Wey at the Elmira Reformatory (Year Book 1895 of the N. Y. State Ref.)

† "The mendicant thieves are well known to prison officials as a class of persons of weak intellect, who tramp through the country, prowling about the different houses, and begging or stealing as the opportunity offers; and it is by them that arson, rape and other crimes are often committed. In the county of Cumberland (Eng.), a few years ago, the practice of committing them to prison as soon as they crossed the border was enforced. *The direct result of this was a considerable increase in the number of admissions into the county asylum* (italics my own), to which they were transferred from gaol as being persons of imbecile or unsound mind."--Maudsley, "Responsibility in Mental Disease."

‡ Four of these have recently been transferred to insane asylums. Three were cases of mania and the fourth melancholia with suicidal tendencies.

REVIEW.

It would probably appear that a defense of the author's subject as an introductory note to a review of it would arise from one of two sources; either an existing doubt in his own mind, or general opposition from the ranks of his professional brethren

Neither of these exist in the present instance, but the author has met some opposition to criminal and alien anthropology generally emanating principally from those engaged in psychological psychiatric investigation. That this attitude is due, in great measure, to the mental bias arising from the trend of their own subjects seems probable.

It *may* be that, ultimately, psychologists will establish the fact that "the kingdoms of mind and matter run side by side in parallelism which never admits of vital contact or reciprocal influence at any point." Until such time as this may be accomplished we must, however, accept the obvious clinical facts as scientific truths, and admit that all physical influences effect the psychical being and *vice versa*.

In one or two other instances adverse criticism has been expressed by thinking members of the medical profession because of the seemingly ill-defined plan and scope of the subject of criminal and alien anthropology. Its scope is, indeed, practically unlimited, embracing as it does man in his several relations.

Its ultimate plan is to analyze the natural and artificial forms of men of a given nation or tribe in their several relations, in order to detect the forces which cause divergences and analogies among them, and to build thereon a classification of that people into normal and abnormal.*

The *immediate* intention is to study the conditions as they exist in the individual for the purpose of deciding which are congenital and which arise from other and subsequent

* Maudsley, in writing on the occurrence of criminal and insane, says: "They are neither accidents nor anomalies in the universe, but come by law and testify to causality; and it is the business of science to find out what the causes are and by what laws they work." (Responsibility in Mental Disease).

conditions. Upon our knowledge of these facts would depend, first, the opinion as to whether or no the conditions were remediable, and, second, the corrective agents most likely to prove beneficial.

A rational working basis may be established by the assumption of a simple definition for the term anthropology as applied to the unstable classes: A life history of the subject, together with his measurements, and a consideration of such abnormalities as may be present. All applied in a comparative way to the general ethnological conditions existing in the nationality considered.

The influence of heredity, physical, mental and moral are too well understood and too generally accepted to necessitate discussion. The first is evidenced in everyday life. As an example of mental heredity the Bach family has been frequently quoted. The inheritance of the lesser mental habits, tricks of memory, peculiar forms of thought, the seemingly involuntary mental attitude, aggressive or defensive, towards any subject prior to consideration, etc., etc., may be observed by closely watching a father and son, even when the education or mode of life of the latter far removes him from his parent.

Moral heredity has been demonstrated by various writers. Mr. Dugdale* especially has pointed out that a heritage of crime and pauperism is a fact.

On further inquiry the fact that good physical heredity is associated with the best balanced intellectual and moral qualities forcibly presents itself.

The reverse of this is, therefore, also true.

The factors contributing to the formation of a bad heredity play such prominent rôles in the establishment of vicious early environment that we must necessarily consider these subjects together.

The extremely small proportion of cases in which it was possible to trace the family history to the grandparents renders that portion of this study of comparatively small importance. There is, however, a certain significance in

* "The Jukes."

percentage of intemperance ($62\frac{1}{2}$ per cent), disease ($12\frac{1}{2}$ per cent), and of death from apoplexy and phthisis ($33\frac{1}{3}$ per cent), amongst the progenitors of our subjects.

The excessive use of alcohol was, twenty years ago, an almost universal custom in the south of Ireland.

It is impossible, from our data, to say that the indulgence of our 24 cases was in excess of that of the average person resident in their vicinity; so that, aside from the known fact that intemperance in the parents tends toward a neuropathic element in the child, we may not logically conclude that this indulgence materially effected their offspring.

When, however, we associate this intemperance with those evidences of constitutional instability, phthisis, epilepsy, and hip-joint disease (tuberculosis), and also consider the large percentage of deaths from apoplexy, we may naturally conclude that neuropathic offspring must result.

In considering the conditions existing in the parents and effecting the heredity and early environment of their offspring, disease and vicious habits are of paramount importance, inasmuch as, by their absence or presence, they predispose the children to minds respective of either good or bad, as the case may be, together with will power strong or lacking in inhibitory control, and also to stable or unstable physical conditions which either do or do not maintain their equipoise under adverse circumstances.

Constant indulgence in alcohol is, in the person himself, both a vice and disease. In his offspring it causes similar conditions, but, as in the immediate text we are dealing exclusively with the physical, we will consider its effects as simply disease.

Including habitual drunkards, we have 28 per cent of disease in the parents of these criminal subjects. Aside from these 30 diseased persons there occurred 22 males and 2 females who drank to excess occasionally but attending to their duties, and 30 females who drank alcohol daily, but never to excess. Added to these conditions we

find $2\frac{8}{10}$ per cent of deformities, the result of interference with embryonic development.

Following this line of investigation to the uncles and aunts of the criminals we find, though the data are limited, that $21+$ per cent were diseased.

The conditions existing among the brothers and sisters, $27-$ per cent diseased and $7+$ per cent criminal, give additional proof of the neuropathic elements in these families.

The mental endowments, mode of life (habits, etc.), religious tendencies, and vocations of the parents naturally exercise considerable influence upon their children during the most receptive years of their lives—that time when they are most completely under parental influence.

Reference to the preceding tables shows that more than 64 per cent of these parents were either absolutely illiterate or possessed of the most meagre educations, while an additional $33\frac{1}{3}$ per cent enjoyed educational advantages only about equal to those attained in the primary departments of our public schools of to-day.

The habits of the parents were, we must assume, not of a nature conducive to the elevation of their children, and the abuse of alcohol, particularly, here plays an important part in the production of vice, or, at least, of vicious tendencies, in their children.

While under certain circumstances the observance of religious forms may be considered as an index to character, the fact that the people of the south of Ireland are held in almost absolute control so far as outward forms are concerned by the dominant church, in the present instance cancels the value of such data. For the same reason, however, the fact that 14 did *not* observe these forms is of particular significance.

It is a good rule, which like all good rules has its exceptions, that the less the intellectual requirements of an avocation the more marked is the absence of self-control and beneficial application in its followers.

In these parents a large number (amongst the males,

and the status of the females must be, in a great measure, that of their consorts) were laborers and *Irish* farmers, while 9 were without occupation. Of the remainder the occupations were somewhat scattered, though only 7 could be said to have engaged in business which, on their surfaces, would lead to the supposition that they were men of sufficient mental attainments to direct, with reason, the training of their offspring.

Regarding the later environments of these criminals we would naturally expect them to be bad. Reference to the table of occupations of criminals shows that they improved but little, if any, over their parents.

The natural tendencies of man lead him always in the path of greatest ease, i. e., downward, and these men having no good example to emulate and lacking, through ignorance, incentives to exertion, readily took that course, perhaps unconsciously.

A consideration of the above conditions leads simply to one conclusion:—the odds were very much in favor of the production of a neuropathic element in the children and a lack of proper training of them.

That this conclusion is justified by the conditions found in the progeny cannot be controverted.

From the anthropometry we can gain nothing of particular importance save that the extremes of measurements occurred more frequently in the criminals than in the normal.

In tabulating the special anthropological signs I have included the number of child of the parents. It will be seen that by far the largest number were *first* children, which coincides with the theory that first born children are liable to the greatest number of accidents during birth.

It is also worthy of note that all were born during the best part of their parents' lives, i. e., between the ages of 25 and 40 years, and that the average male age of the parents at that time exceeded that of the females by about two years.

We will first consider the so-called anatomical stigmata—

the various deformities—or, as Peterson has denominated them, the “Indices of Degeneration.”

Of these the most important and the most constant were cranial deformities. By reference to the foregoing table it will be seen that asymmetry of the cranium occurred in 97 per cent of my subjects.

It may also be of significance that this asymmetry appeared most prominently over the anterior parietal, temporal, and frontal regions of the cranium.

Second in point of frequency must be placed facial asymmetry—excessive prognathism, retrognathism, etc. In collecting data referring to these conditions I was unable to obtain any photographs.

Deformities of the hard palate occurred in a large number of the subjects and varied greatly in character.

There occurred, however, in 175 men of all nationalities and conditions (not criminal, insane, or neuropathic) examined by me the same deformities though in lesser proportion (20 per cent).* In these 35 useful citizens presenting palatal deformities there was present a minimum of mental and physical endurance and activity.

Dental anomalies, such as irregular or misplaced teeth, microdontism, Hutchinson's teeth, and a defective dental enamel, either too hard or too soft, were present in a large proportion of the subjects.

Irregularities of the ear were fairly constant and presented a number of different varieties (see table). Binder and Knecht in their separate studies have demonstrated the frequency of the degenerate ears in the insane and criminal classes. Binder† found 64 per cent of such deformities in 354 insane, and Knecht found 20 per cent among 1,274 criminals.

My own observation of 175 normal people shows 13½ per cent of degenerate ears.

The “degenerate uvula”‡ occurred in 15+ per cent of

* Charon found palatal deformities in 10 per cent of normal people.

† Medical Annual, 1897.

‡ Medical Press and Circular, Aug. 26, '96.

my criminal subjects; the innervation of the palate being deficient, it was deviated towards one side.

The occurrence of these stigmata considered separately signifies little, for as above stated they occur, though somewhat less frequently, in normal people. The *association*, however, of three or more of them in the same individual is usually indicative of deficient natural forces.

It is possible to find certain stigmata associated in persons outside of institutions. I have observed 7 subjects, presumably normal persons, presenting such conditions, but in each case there was elicited, upon examination, some neuropathic element either personal or in the family history.

In my criminal cases cranial asymmetry, palatal deformities and anomalies of the ears were associated in 33 men. Cranial and facial asymmetry in 12. Palatal deformities, irregular ears and the degenerate uvula occurred in 11 men. The peculiar uvula not occurring alone in any case.

Irregular and defective denture occurred in all these cases. There were only 17 cases presenting no association of these anatomical abnormalities.

Peculiarities of the noses, foreheads, etc., are apparently of no significance. The frequency of occurrences of the "oblique" eye and the narrow palpebral fissures perhaps have some import when associated with the grosser irregularities.

Flecks upon the iris and pigmentary deposits in the skin were infrequent.

The conditions of the reflexes, urinary organs, bowels, circulation, heart and muscular system give further proofs of the physical instability of the criminals as a class.

It is obviously impossible to discuss separately the various psychical phenomena hereinbefore noted. The same conditions existed, perhaps in a lesser degree, which we find amongst the insane. In fact the same conditions are the (immediate) cause of the incarceration of both classes.

The foregoing data make certain general conclusions possible. These men were, without doubt, of hereditary neurotic types. Their early environments rather added to than corrected the inherited weaknesses. As the men grew to adult life their weak and vacillating mental states led them into irregular or uncertain employment, while the excessive egoism always attendant upon such conditions coupled with the inherent lack of conception of moral laws, made the attainment of their ends by questionable means mentally possible.

The associated stigmata prove the extent of the influence of parental defects.

Given a certain number of Munster and Connaught Irishmen with conditions similar to the above and an extremely large proportion of them will become either criminal or insane.

The following plates illustrative of the contours of the circumferences of the heads of these criminals are introduced for the purpose of showing, more clearly than possible in the text, the general method of procedure, and also the results obtained.

To introduce herein all of the 73 drawings would be impracticable and, consequently, the following 18 have been selected. These present characteristically practically all of the head deformities found at the examinations, which deformities may properly be divided into six principal groups (though such grouping is somewhat arbitrary) as follows:

GROUP I—Plates 1, 2, 6, 16. Showing flattening of the left temporal and regions. Narrow foreheads.

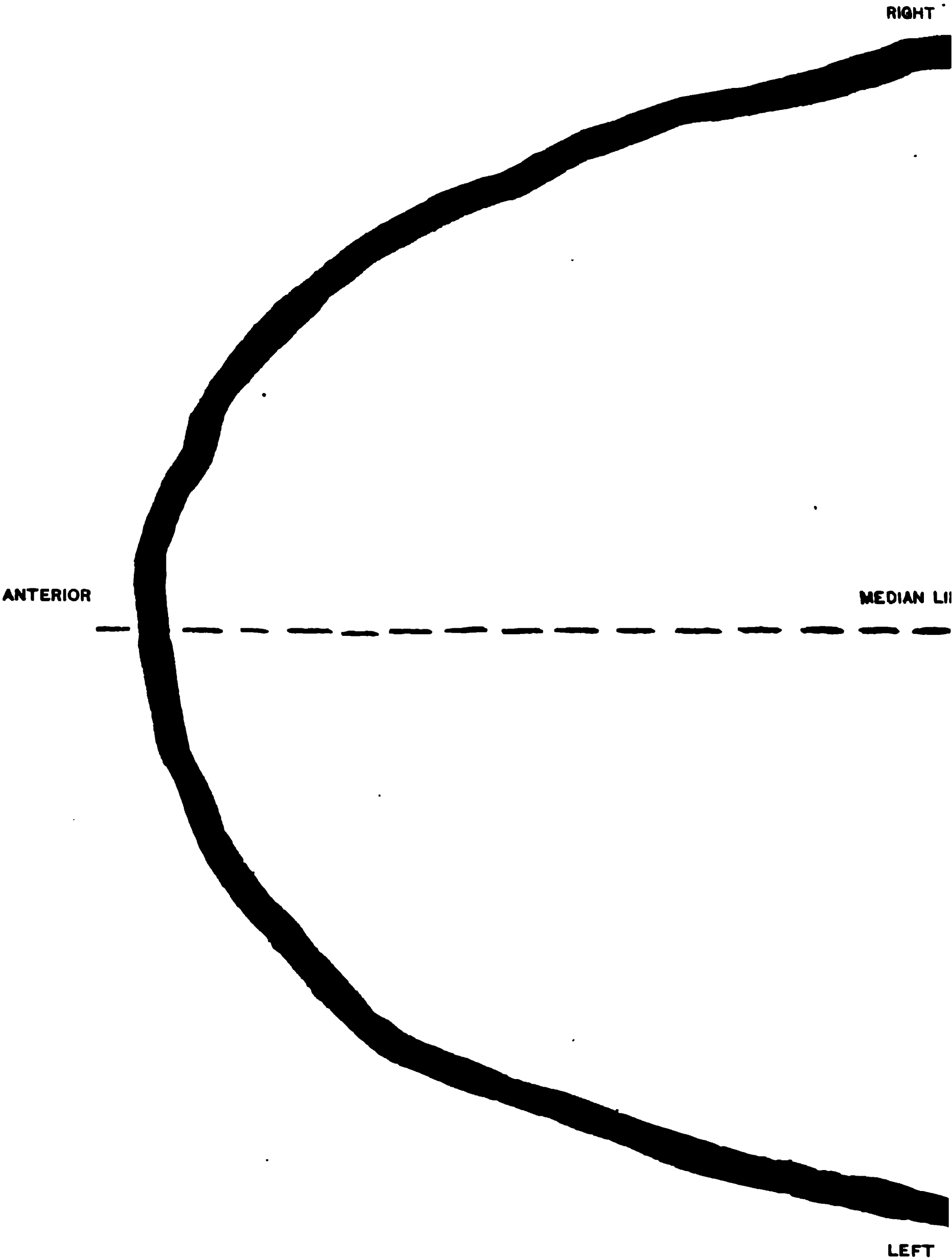
GROUP II—Plates 3, 13. Showing entire left half of head smaller than right.

GROUP III—Plates 5, 12, 15. Showing flattening of the right temporal and frontal regions.

GROUP IV—Plates 8, 9, 11. Showing narrow, peculiarly asymmetrical heads.

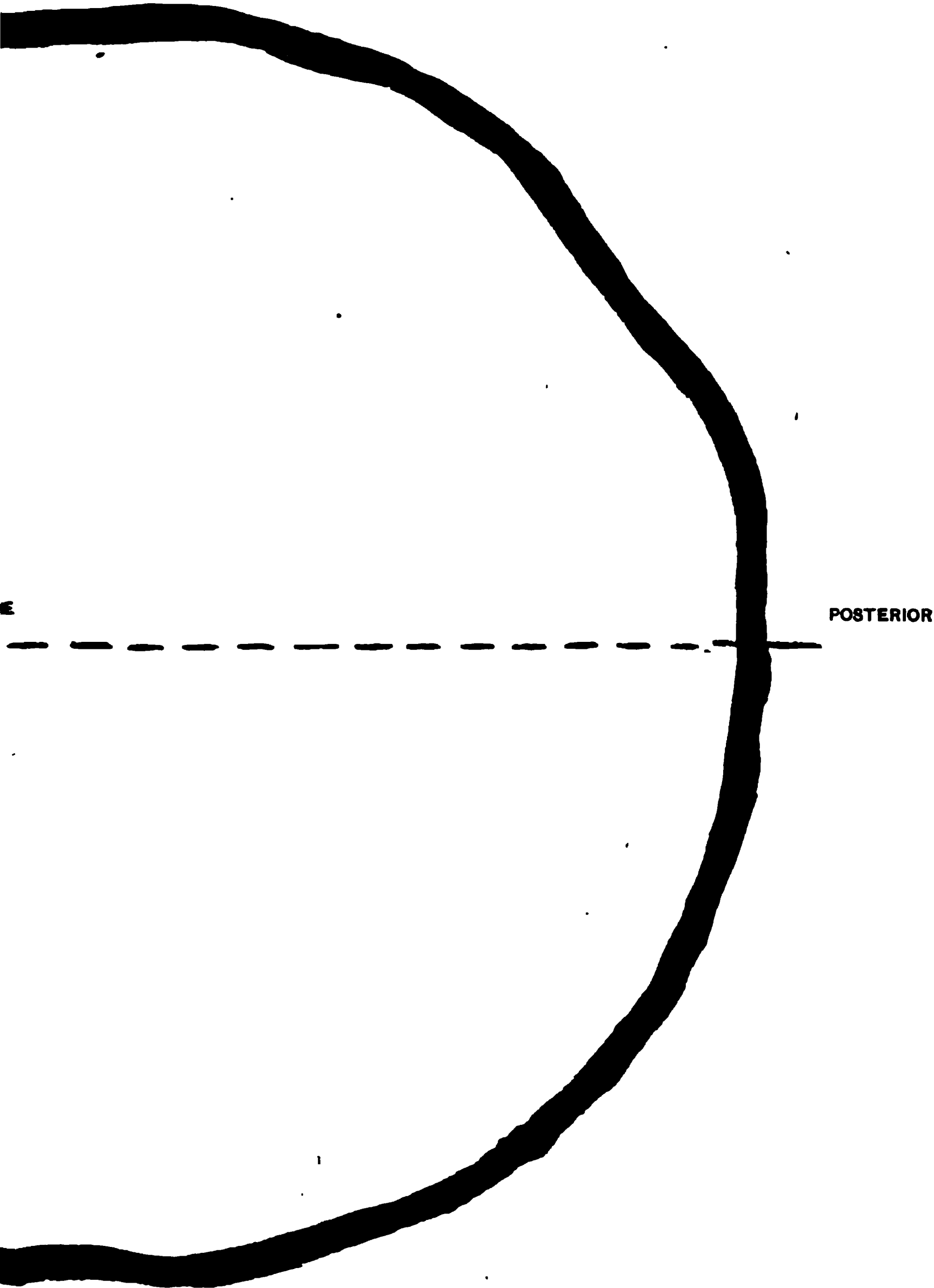
GROUP V—Plates 4, 7, 14, 18. Showing general asymmetry.

GROUP VI—Plate 10. Showing flattening of the occiput. This shaped head is properly the Jewish type. This is the only Irish subject in whom I have found this condition.



CONTOUR CIRCUMFERENCE OF HEAD OF M—. ASSO

HEAD LENGTH, 19.5 CM.



IATED STIGMA: LOW, ASYMMETRICAL PALATE

WIDTH, 15.5 CM.

RIGHT.

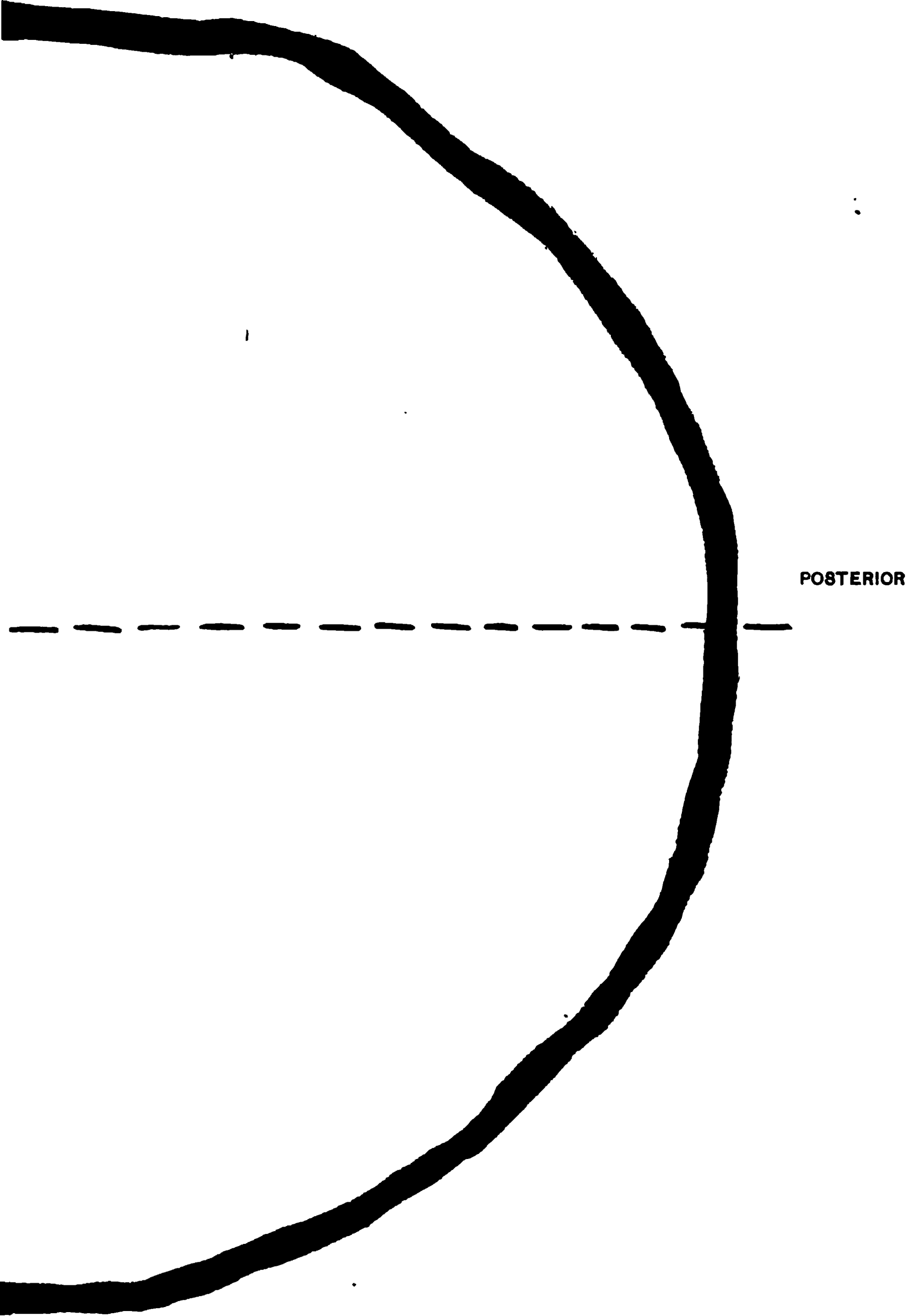
ANTERIOR

MEDIAN L/M

LEFT

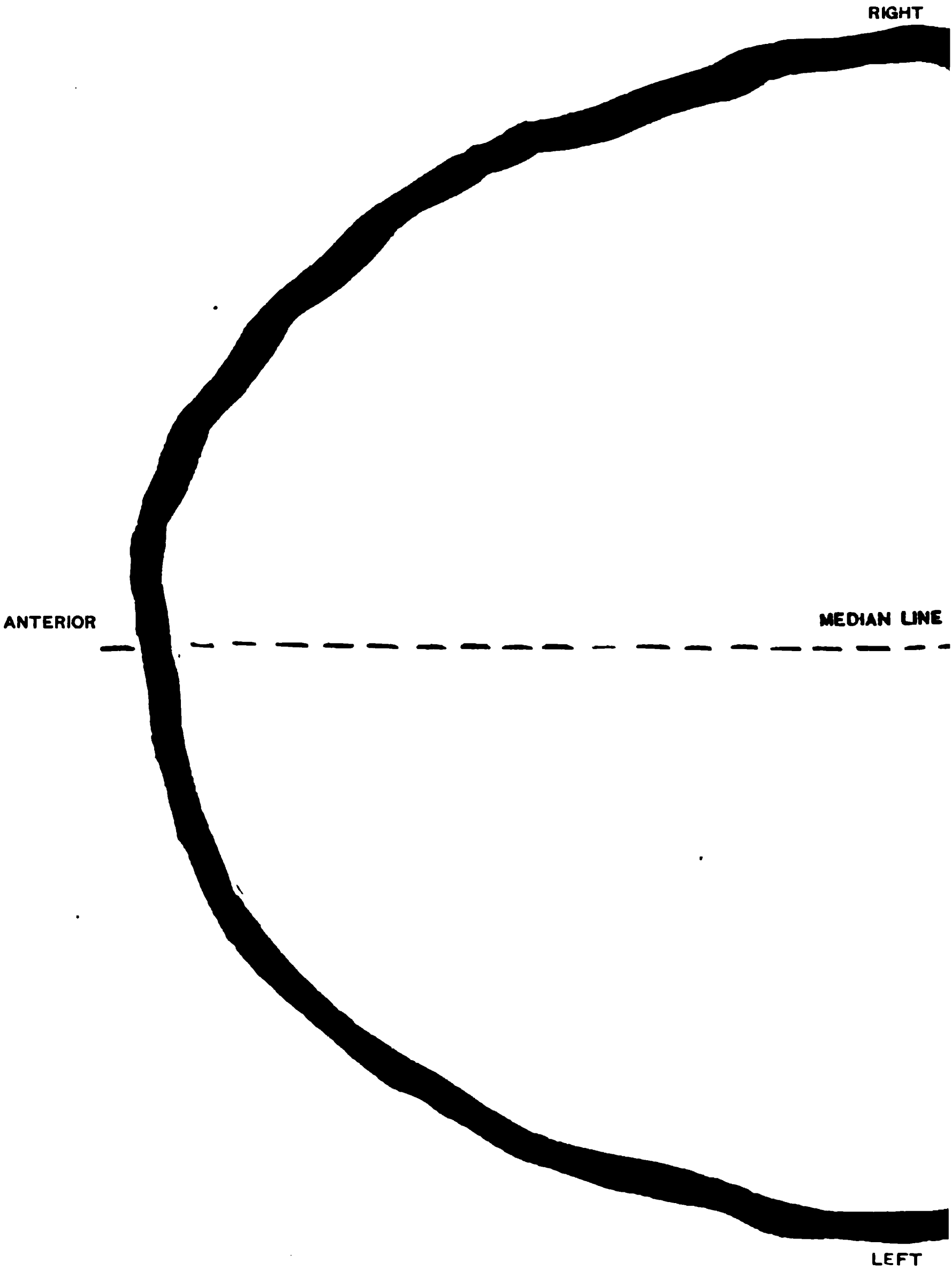
CONTOUR CIRCUMFERENCE OF HEAD OF B

HEAD LENGTH, 18.5 CM. W



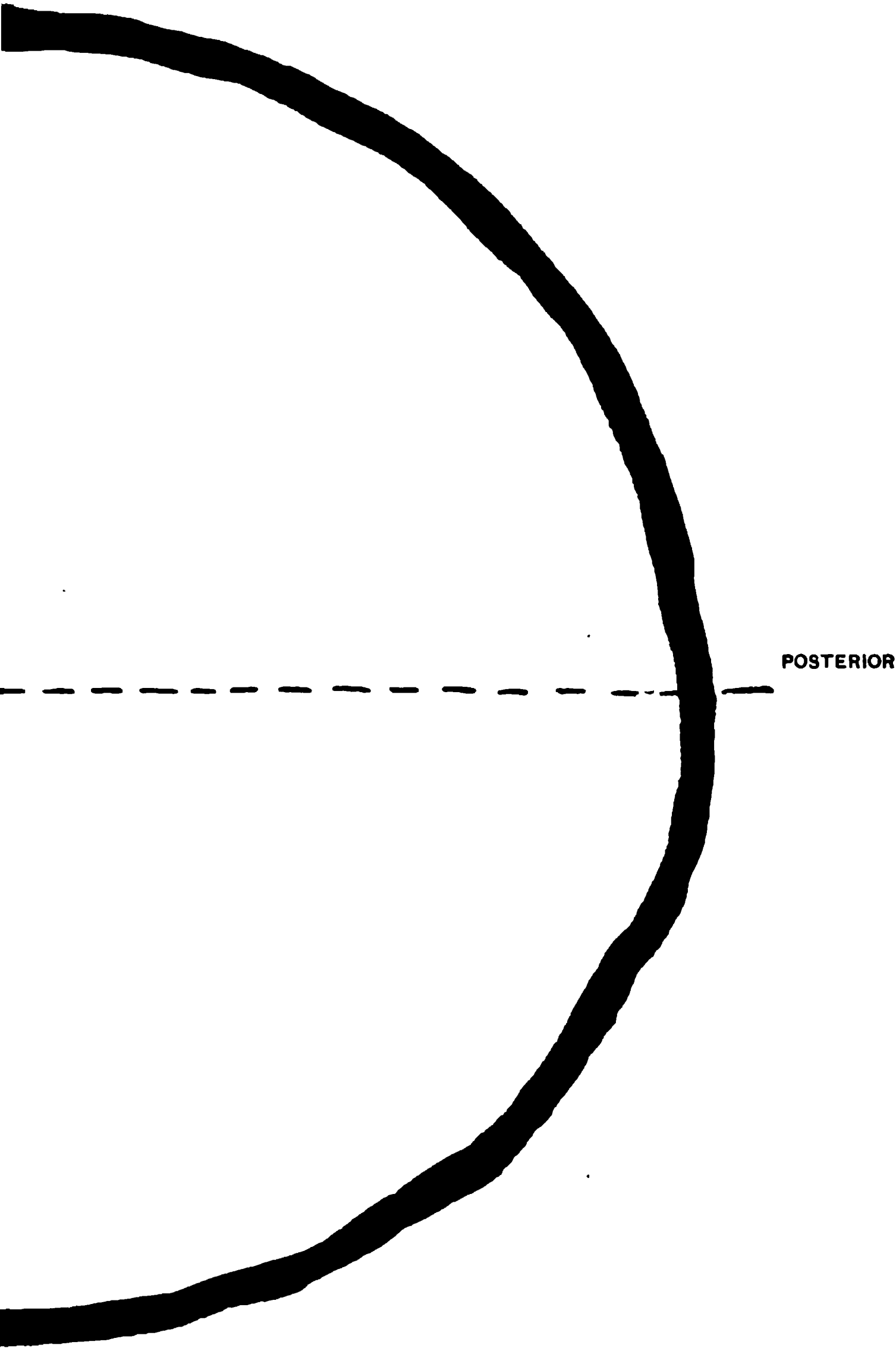
NO ASSOCIATED STIGMATA

TH, 15.5 CM.



CONTOUR CIRCUMFERENCE OF HEAD OF L—. ASSOCIATED STIGMATA: HIGH,
MICRODENTI

HEAD LENGTH, 17.9 cm. \



SHORT, NARROW ARCHED PALATE: TEETH POOR AND MUCH WORN,
|

TH, 14.8 CM.

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